

PROPER AUTOMOTIVE WASTE MANAGEMENT

RESOURCE MANUAL



October 2003

Zero Waste—You Make It Happen!

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The energy challenge facing California is real.

Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, **Flex Your Power** and visit www.consumerenergycenter.org/flex/index.html.

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PROBLEMS (CHALLENGES AND BARRIERS)

Environmental Impact

Environment is all of the external factors affecting an organism. These factors may be other living organisms (biotic factors) or nonliving variables (abiotic factors), such as water, soil, climate, light, and oxygen. All interacting biotic and abiotic factors together make up an ecosystem.

Organisms and their environment constantly interact, and both are changed by this interaction. Additionally, environmental factors, singly or in combination, ultimately limit the size that any population may attain. This limit, a population's *carrying capacity*, is usually reached because needed resources are in short supply. Occasionally, carrying capacity may be dictated by the direct actions of other species, as when predators limit the number of their prey in a specific area.

Like all other living beings, humans have clearly changed their environment, but they have done so generally on a grander scale than have other species. Some of these changes—such as the destruction of the world's tropical rain forests to create grazing land for cattle, or the drying up of almost three-quarters of the Aral Sea, once the world's fourth-largest freshwater lake, for irrigation purposes—have led to altered climate patterns, which in turn have changed the distribution of species of animals and plants.

Scientists are working to understand the long-term consequences that human actions have on ecosystems, while environmentalists—professionals in various fields, as well as concerned citizens in the United States and other countries—are struggling to lessen the impact of human activity on the natural world.

Understanding The Environment

The *science of ecology* is the study of the interactions that determine the abundance and distribution of organisms. In other words, ecology attempts to explain why individuals live where they do and why their populations are the sizes they are.

Question
1

No population, human or otherwise, can grow indefinitely; eventually, some biotic or abiotic variable will begin to limit population growth. This basic ecological principle was first established in 1840 by German chemist Justus von Liebig and has been called the *Law of the Minimum*. From a human standpoint, this means that all of the world's physical resources are in finite supply.

Ecologists also have discovered that all species in an ecosystem interact with one another, either directly or indirectly. A classic ecological experiment illustrates this point very well.

American ecologist Robert Paine, working in the rocky intertidal region of the Pacific coast, found stable invertebrate communities dominated by fifteen species of animals, including starfish, mussels, limpets, barnacles, and chitons. When Paine removed all of the starfish from the area, the community collapsed, and eventually only eight invertebrate species were common. Although it was not obvious in the undisturbed regions, the starfish were preying heavily on one of the mussel species and keeping its numbers down. With the starfish removed, the population of this mussel increased, and the mussel was able to out-compete many other species of invertebrates. Thus, the loss of one species, the starfish, indirectly led to the loss of an additional six species and a transformation of the community.

Typically, because the species that coexist in natural communities have evolved together for many generations, they have established a balance, and their populations remain relatively stable. Occasionally, when humans introduce a non-native species to an ecosystem, dramatic disruptions occur, often because the natural predators of the introduced species are not present. For example, early sailors routinely introduced goats to isolated oceanic islands, intending for the goats to roam freely and serve as a source of meat when the sailors later came ashore. Free from all natural predators, the goats thrived and, in the process, overgrazed many of the islands. With a change in plant composition, many of the native animal species were driven to extinction. A simple action, the introduction of goats to an island, yielded many changes in the island ecosystem, demonstrating that all members of a community are closely interconnected.

In the 1970s the British scientist James Lovelock formulated the Gaia hypothesis, which has attracted many followers. According to this theory, named after the Greek goddess of the earth, the planet behaves like a single living organism. Lovelock postulated that the earth, like many organisms, could regulate its temperature, dispose of its wastes, and fight off disease. Although the Gaia hypothesis serves as a convenient metaphor for the interconnections among living beings, it does not have any particular scientific merit.

From a scientific viewpoint, the earth is not a single living organism, but it can be viewed as a single integrated system. The National Aeronautics and Space Administration (NASA), using its expertise in planetary and space sciences, is collaborating with other U.S. governmental agencies in the use of artificial satellites to study global change. NASA's undertaking, begun in 1991, is called Mission to Planet Earth. This project is part of an international effort linking numerous satellites into a single Earth Observing System (EOS). EOS is designed to increase knowledge of the interactions taking place among the atmosphere, land, and oceans; to assess the impact of natural and human events on the planet; and to provide the data that permit sound environmental policy decisions to be made.

The Impact

Many of the global environmental issues that we face today and in the future are the same as those of the past century. Issues such as *overpopulation, deforestation and*

desertification have been part of global history for centuries. More recent environmental issues include *ozone depletion, global warming, acid rain, toxic airborne emissions, waste generation, and disposal problems as well as depletion of nonrenewable resources.*

For the most part, environmental issues are linked in more than one way. Human populations, food, water and energy are linked. How a country chooses to address the issues and problems associated with a growing population's increasing use of land and water for living, industrialization, and use of land, water and atmosphere for waste disposal will have a lasting impact on that country's economy and human development.

Industrial development has always included accidents, including explosions, seepage of toxins into soil or water, and atmospheric releases. In America one of the worst industrial accidents occurred on April 16, 1947, when a freighter being loaded with nitrate exploded. The resulting three-day fire caused 752 deaths, injured another 3,000 people, and destroyed much of the infrastructure and housing in Texas City, Texas. More recent shipping-related accidents have involved the release of harmful chemicals, especially crude oil, resulting in severe environmental and economic impact.

Question 2

Three oil shipping accidents in particular have resulted in more stringent environmental regulations. The *Amoco Cadiz*, which was owned by the U.S. company Standard Oil, ran aground while off the Brittany coast of France on March 16, 1978. The ship's steering gear was damaged by the heavy waves of storm-force gales. The result: 68.7 million gallons of oil were spilled.

The French government employed approximately 8,000 people to clean the entire coastline, and Standard Oil paid \$16.7 million to the French for restitution. More than 22,000 seabirds were killed, and the oyster industry suffered for months. But the coast suffered less damage than originally anticipated because of the sea's natural cleansing action.

As a result of this accident, supertankers now have to have exceptionally strong steering gear. The primary lesson learned from this disaster was that the captain of the tanker must be the sole judge of danger to his ship and must act accordingly in order to prevent delay of proper action.

On March 24, 1989, the *Exxon Valdez* hit submerged rocks on a reef in Prince William Sound off the southern coast of Alaska, releasing 11 million gallons of crude oil. The captain was drunk on duty and had retired to his cabin, leaving an inexperienced crew member to guide the ship through the Sound.

The resulting environmental devastation included the death of 34,000 shore birds, 1,000 sea otters and uncounted numbers of fish, which jeopardized the area's \$100

million per year fishing industry. The total cost of the spill and cleanup attempts was \$1.5 billion.

Prior to construction of the Alaskan Pipeline, many environmentalists raised issues concerning the possibility of an oil spill in the Sound, but officials of Alyeska, the oil consortium formed to pump oil from Alaska's north slope to the terminus in Valdez insisted that a spill would be "unlikely." They assured congress that they would have trained people on a spill site within five hours.

However, the company disbanded its full-time highly trained cleanup crew during the mid-1980s and replaced it with a part-time inexperienced one. More than 14 hours passed after the spill before this crew arrived at the spill site. In response to this accident, Congress passed the Oil Pollution Act of 1990. This law revised section 311 of the Clean Water Act to prevent future oil and hazardous substance discharges; tighten ship, personnel, and equipment requirements; create a \$1 billion cleanup fund; strengthen federal oil removal authority; and increase civil and criminal penalties for the spilling of oil into the sea.

Many global issues create controversy in the scientific community, and on every issue scientists hold opposing points of view. One such example is global warming. Some scientists believe that we are entering a warm period. This could be due to increased accumulations of atmospheric carbon dioxide and other greenhouse gases such as methane, nitrous oxide, and freons known as CFCs (chlorofluorocarbons) that trap heat.

Data analysis indicates that during 1970–80, the carbon dioxide input calculated to increase the average air temperature approximately 0.14°C and the other gases would collectively lead to a 0.10°C increase. These gases are mainly produced by human combustion of fossil fuels. Other scientists point out that too little is known about the fundamental factors that drive the earth's climate to draw any conclusions about human activity and global warming.

Examples of serious environmental consequences from human behavior include pollution from excessive consumption of nonrenewable energy resources, such as oil, gas, and minerals. The extraction and processing of these resources results in the release of wastes on land, in water, and in the atmosphere. Other examples include the release of large amounts of inorganic nitrogen, phosphorous, and carbon into bodies of water and groundwater. This leads to excessive plant production; toxicity of drinking water from pesticides, herbicides and other chemicals; and the breakdown of soils due to over-cultivation.

Contamination of water has its own particular issues and consequences. The ocean contains approximately 97 percent of all the water on earth. Of freshwater, the remaining 3 percent, 70 percent is locked up in glaciers, permanent snow cover, or permafrost and is unavailable for use in the most practical sense of the word. Therefore the relatively small amount of freshwater contained in lakes, swamps, rivers, and groundwater is all that is available to satisfy the needs of all living systems.

Historically, wastes generated by industry and waste treatment facilities in this country were discharged in streams, rivers, lakes, and estuaries. In the not-too-distant past, these discharges included untreated hazardous wastes and by-products, which not only made drinking water unsafe, but also altered ecosystems.

Recent legislation and new technology, including point source control of contaminants, and nonpoint source pollution prevention and recycling, have led to a decrease in the hazardous materials being placed directly in the water of the United States. Industry is frequently blamed for introducing the largest amount of hazardous wastewater to waterways and sewage treatment plants. However, in many instances the cumulative input of individual households engaged in activities such as fertilizing, herbicide and pesticide use, and improper disposal is far greater than industry's when it comes to certain contaminants.

Global warming, acid rain, and other atmospheric issues may be local or regional in their environmental impacts and affect more than one country. The cause of these problems is man's need for increasing amounts of energy. Modern living and exploration, ranging from running a biomedical implant to powering space travel and satellites, requires energy.

Ninety percent of all energy is produced by the combustion of oil, gas, coal, peat, and oil shale. Recent oil production has fallen by 1 percent due to efficiency, conservation, and the breakup of the former Soviet Union, the world's top oil producer. The air has become increasingly polluted because of growing dependence on the use of fossil fuels for transportation, factory operation, and heating/cooling buildings.

Many governments and industries have realized the environmental and economic value of implementing pollution prevention measures. Many of these measures involve use of substitute technologies that improve current industrial practices by reducing pollution or resource use and increasing process efficiency. These measures are leading us toward more sustainable development.

The concept of "Pollution Prevention Pays" (3P) was first demonstrated by the 3M Corporation. The company encourages innovation by all of its manufacturing, laboratory, and engineering employees in the areas of product reformulation, process modification, equipment redesign, and recovery of waste material for reuse. The value of each suggested project is evaluated based on elimination or reduction of a pollutant, improved use of energy or raw materials, and monetary benefits. During a six-year period, more than 500 3P projects in 20 countries saved the 3M Corporation \$97 million. Many other industries are following suit in developing substitution technologies. While these new technologies will provide a reasonable approach to reducing the loss of natural resources, their environmental consequences must also be fully investigated.

A Global Approach

Question
3

The environmental concerns growing in the United States during the late 1960s and early 1970s increased internationally as well. Perhaps the biggest impetus for developing a worldwide effort to monitor and restrict global pollution is the fact that most forms of pollution do not respect national boundaries.

The first major international conference on environmental issues was held in **Stockholm, Sweden**, in 1972, and was sponsored by the United Nations (UN). This meeting, at which the United States took a leading role, was controversial because many developing countries were fearful that a focus on environmental protection was a means for the developed world to keep the undeveloped world in an economically subservient position. The most important outcome of the conference was the creation of the United Nations Environmental Programme (UNEP).

UNEP was designed to be “the environmental conscience of the United Nations,” and, in an attempt to allay fears of the developing world, it became the first UN agency to be headquartered in a developing country, with offices in **Nairobi, Kenya**. In addition to attempting to achieve scientific consensus about major environmental issues, a major focus for UNEP has been the study of ways to encourage *sustainable development*—increasing standards of living without destroying the environment. At the time of UNEP's creation in 1972, only 11 countries had environmental agencies. Ten years later that number had grown to 106, of which 70 were in developing countries.

A growing number of international agreements have been reached in an effort to improve the world's environmental status. In 1975 the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) went into effect with the goal of reducing commerce in animals and plants on the edge of extinction. In 1982, the International Whaling Commission agreed to a moratorium on all commercial whaling.

Perhaps the most important international agreement was the 1987 *Montreal Protocol on Substances that Deplete the Ozone Layer*. For the first time, an international pact was signed that set specific targets for reducing emissions of chemicals responsible for the destruction of the earth's ozone layer. The international community again came together in 1989 to limit the movement of hazardous wastes among countries.

In 1992, 20 years after the Stockholm Conference, the *UN Conference on Environment and Development* was held in **Rio de Janeiro, Brazil**. Popularly known as the Earth Summit, this meeting was the largest gathering of world leaders in history. The conference produced two major treaties. The first was an agreement to reduce emission of gases leading to global warming, and the second was a pact on biodiversity requiring countries to develop plans to protect endangered species and habitats.

At the insistence of the **United States**, however, the final version of the global warming treaty was dramatically scaled back. The United States was also one of the very few countries that refused to sign the biodiversity treaty. United States representatives objected to a part of the treaty that specified that money to come from the use of natural resources from protected ecosystems, such as rain forests, should be shared equally between the source country and the corporation or institution removing the materials.

The 1992 agreement on global warming limits each industrialized nation to emissions in the year 2000 that are equal to or below 1990 emissions. However, these limits are voluntary, and no enforcement provisions were included in the agreement. By 1997, it was clear that the goals would not be met.

At a follow-up conference in **Kyoto, Japan**, representatives from 160 countries signed a new agreement, known as the Kyoto Protocol. This agreement calls for the industrialized nations to reduce emissions to an average of about 5 percent below 1990 emission levels and to reach this goal between the years 2008 and 2012.

In late March 2001, President Bush announced that the U.S. would withdraw from the Kyoto Protocol. In the absence of ratification, the treaty is not considered legally binding. The CRS Issue Report, *Global Climate Change: The Kyoto Protocol* (2001) describes the political negotiations that occurred from the drafting of the protocol in 1997 to its current-day rejection by the U.S., while the CRS Report, *Global Climate Change: Selected Legal Questions About the Kyoto Protocol* (2001) explains the legal implications of signing, but not ratifying, the protocol.

Bush suggested in his June 11, 2001, remarks that instead of committing to the Kyoto Protocol standards, the U.S. would combat global warming in other ways. In a *Climate Change Review* issued the same day, he listed development of energy-efficient technology, market-based incentives to encourage industries to reduce greenhouse gas emissions on their own, and conservation programs that help sequester carbon in the soil, as actions the U.S. would take.

A desire for environmental change led to the creation of various political parties around the world whose emphasis was largely on environmental protection. The first of these organizations, collectively known as *green parties*, was the Values Party in **New Zealand**, created in 1972. By far the most successful has been the green party of **West Germany**, Die Grunen, which in 1983 won nearly 6 percent of the seats in the West German Parliament.

Green parties have developed in almost all countries that have open elections, but they have had the largest impact in those nations where proportional representation within a parliamentary system occurs. Thus, the green parties have not played a significant role in American politics. In 1993, 23 green parties from eastern and western Europe came together to form the European Federation of Green Parties, with the hope that together they would have the leverage necessary to demand that

environmental issues such as pollution control, population growth, and sustainable development be more fully addressed by various national governments and international bodies.

Global Warming

Question
4

Like the glass panes in a greenhouse, certain gases in the earth's atmosphere allow the sun's radiation to heat the earth but they retard the escape of infrared energy the earth radiates back into space. This process is referred to as the *greenhouse effect*.

Question
5

These gases, primarily carbon dioxide, methane, nitrous oxide, and water vapor, insulate the earth's surface, helping to maintain warm temperatures. Without these gases, the earth would be a frozen planet with an average temperature of about -18°C (about 0°F) instead of a comfortable 15°C (59°F). If the concentration of these gases is higher, more heat is trapped within the atmosphere, and worldwide temperatures rise.

Within the last century, the amount of carbon dioxide in the atmosphere has increased dramatically, largely because of the practice of burning fossil fuels—coal and petroleum and its derivatives. Global temperature has also increased 1°C (about 1.8°F) within the past century. Atmospheric scientists have now concluded that at least half of that increase can be attributed to human activity, and they have predicted that unless dramatic action is taken, the temperature will continue to rise by between 1° and 3.5°C (between 1.8° and 6.3°F) over the next century. Although this may not seem like a great difference, the global temperature was only 2.2°C (4°F) cooler during the last ice age than it is presently.

The consequences of such a modest increase in temperature may well be devastating. Sea levels will rise, completely inundating a number of low-lying island nations and flooding many coastal cities such as New York and Miami. Many plant and animal species will probably be driven into extinction, agricultural regions will be disrupted, and the frequency of severe hurricanes and droughts is likely to increase.

Depletion of the Ozone Layer

Question
6

The ozone layer, a thin band in the stratosphere (a layer in the upper atmosphere), serves to shield the earth from the sun's harmful ultraviolet rays. In the 1970s, scientists discovered that this layer was being attacked by chlorofluorocarbons (CFCs), which are chemicals used in refrigeration, air conditioning systems, cleaning solvents, and aerosol sprays. CFCs release chlorine into the atmosphere; chlorine, in turn, breaks ozone down into its constituent parts of oxygen. Because chlorine is not affected by its interaction with ozone, each chlorine molecule has the ability to destroy a large amount of ozone for an extended period of time.

The consequences of the depletion of the ozone layer are dramatic. Increased ultraviolet radiation will lead to a growing number of skin cancers and cataracts and also reduce the ability of people's immune systems to respond to infection. Additionally, the growth rates of the world's oceanic plankton, the base of most marine

food chains, will be negatively affected, perhaps leading to increased atmospheric carbon dioxide and thus to global warming. Even if the manufacture of CFCs were immediately banned, the chlorine already released into the atmosphere would continue to destroy the ozone layer for many decades. Additionally, the latest studies suggest that global warming may increase the amount of ozone destroyed.

Air Pollution

A significant portion of industry and transportation is based on the burning of fossil fuels, such as gasoline. As these fuels are burned, chemicals and particulate matter are released into the atmosphere. Although a vast number of substances contribute to air pollution, the most common are carbon, sulfur, and nitrogen. These chemicals interact with one another and with ultraviolet radiation in sunlight in various dangerous ways.

Question
7

Smog, usually found in urban areas with large numbers of automobiles, is formed when nitrogen oxides react with hydrocarbons in the air to produce aldehydes and ketones. Smog can cause serious health problems. When sulfur dioxide and nitrous oxide are transformed into sulfuric acid and nitric acid in the atmosphere and come back to earth in precipitation, they form acid rain.

Acid rain is a serious global problem because few species are capable of surviving in the face of such acidic conditions. Acid rain has made numerous lakes so acidic that they no longer support fish populations. Acid rain is also thought to be responsible for the decline of many forest ecosystems worldwide. Germany's Black Forest has suffered dramatic losses, and recent surveys suggest that similar declines are occurring throughout the eastern United States.

Water Pollution

Estimates suggest that nearly 1.5 billion people lack safe drinking water and that at least 5 million deaths per year can be attributed to waterborne diseases. Water pollution may come from point or nonpoint sources. Point sources discharge pollutants at specific locations—from, for example, factories, sewage treatment plants, or oil tankers.

Question
8

The technology exists for point sources of pollution to be monitored, regulated, and controlled, although political and economic factors may complicate technology implementation. Nonpoint sources—runoff water containing pesticides and fertilizers from agricultural and residential land, for example—are much more difficult to control. Pollution arising from nonpoint sources accounts for a majority of the contaminants in streams and lakes.

With almost 80 percent of the planet covered by oceans, people have long acted as if those bodies of water are limitless dumping ground for wastes. Raw sewage, garbage, and oil spills have begun to overwhelm the diluting capabilities of the oceans, and most coastal waters are now polluted. Beaches around the world are

closed regularly, often because of high amounts of bacteria from sewage disposal, and marine wildlife is beginning to suffer.

Government agencies are increasingly using pollution prevention education and laws mandating maximum allowable pollutant loads in waterways to decrease nonpoint source pollution.

Groundwater Depletion

Question
9

Water that seeps through porous rocks and is stored beneath the ground is called groundwater. Worldwide, groundwater is 40 times more abundant than freshwater in streams and lakes, and although ground water is a renewable resource, reserves are replenished relatively slowly. In the United States, approximately half the drinking water comes from groundwater. Presently, groundwater in the United States is being withdrawn approximately four times faster than it is being naturally replaced.

The Ogallala Aquifer, a huge underground reservoir stretching under eight states of the Great Plains, is being drawn down at rates exceeding 100 times the replacement rate, suggesting that agricultural practices dependant on this source of water may have to change within a generation. When groundwater is depleted in coastal regions, oceanic saltwater commonly intrudes into freshwater supplies. Saltwater intrusion is threatening the drinking water of many areas along the Gulf and Atlantic coasts.

Question
10

The EPA has estimated that, on average, 25 percent of usable groundwater is contaminated, although in some areas as much as 75 percent is contaminated. Contamination arises from leaking underground storage tanks, poorly designed industrial waste ponds, improperly disposed hazardous wastes, and seepage from the deep-well injection of hazardous wastes into underground geologic formations. Because groundwater is recharged and flows so slowly, once polluted it will remain contaminated for extended periods.

Chemical Risks

Question
11

Pesticide residues on crops and mercury in fish are examples of toxic substances that may be encountered in daily life. Many industrially produced chemicals may cause cancer, birth defects, genetic mutations, or death. Although a growing list of chemicals has been found to pose serious health risks to humans, the vast majority of substances have never been fully tested. In recent studies, a wide range of chemicals has been found to mimic estrogen, the hormone that normally controls the development of the female reproductive system in a large number of animal species.

Preliminary results indicate that these chemicals, in trace amounts, may disrupt development and lead to a host of serious problems in both males and females, including infertility, increased mortality of offspring, and behavioral changes such as increased aggression. Numerous studies have found that the amount of sperm produced by men has decreased precipitously over the past 50 years.

Environmental Racism

Studies have shown that not all individuals are equally exposed to pollution. For example, toxic waste sites are more prevalent in poorer communities, and the single most important factor in predicting the location of hazardous waste sites in the United States is the ethnic composition of a neighborhood.

Question
12

Three of the five largest commercial hazardous waste landfills in America are in predominantly Black or Hispanic neighborhoods, and three out of every five Black and Hispanic Americans live in the vicinity of an uncontrolled toxic waste site. The fact that the wealth of a community is not nearly as good a predictor of hazardous waste siting as ethnicity reinforces the conclusion that racism is involved in the selection of sites for hazardous waste disposal.

Environmental racism takes international forms as well. Dangerous chemicals banned in the United States often continue to be produced in the U.S. and shipped to developing countries. Additionally, the developed world has shipped large amounts of toxic waste to developing countries for less-than-safe disposal.

Other Issues

Global environmental collapse is not inevitable. But the developed world must work with the developing nations to ensure that their new industrialized economies do not add to the world's environmental problems but instead utilize sustainable methods and technologies.

Politicians will need to promote more sustainable development rather than economic expansion.

Conservation strategies need to be more widely adopted, and people must learn that energy use can be dramatically diminished without sacrificing comfort.

In short, with the technology that currently exists, we can reverse the years of global environmental mistreatment.

Worker Safety

Handling and dealing with hazardous materials and wastes must begin with employee awareness of workplace safety and health. Workers must first know what the hazardous materials they are working with and how to safely handle and dispose of them before they can perform their job with minimum impact to themselves, others, and the environment.

To create this awareness, employees must read and understand material safety data sheets (MSDS) and hazardous material labeling. They also must be informed of the health hazards associated with the many materials found in automotive repair shops.

Keeping The Shop Safe

Preventing on-the-job injuries is everyone's business. This course does not address common injury prevention guidelines because they are generally covered in shop safety classes and seminars.

This course does address how to prevent injuries specific to waste management, including the following potential floor clean-up scenarios:

Floor cleanup:

Question
13

- ❑ Workers can slip and fall from liquids spilled on the floor.
- ❑ Batteries can blow up and spread acid onto the worker and vehicles, and into the environment.
- ❑ Fuel leaks present a danger to the worker, the shop, and the environment.

This course includes specific guidelines on how to properly store, handle, dispose, and clean up products that are potentially hazardous. The key to a successful shop is to find a good balance between being productive and safe, which is possible when operating in compliance with regulations and maintaining a healthy environment.

Inhalation Hazards

The use of petroleum products in the automotive service and repair industry creates several potential hazards for workers. Many petroleum products evaporate to produce gas (vapor) concentrations in the technician's work stall and can migrate throughout the repair facility. For example, fuel system work can generate gasoline fumes.

Question
14

Vapors from hazardous materials most commonly enter the body through inhalation. If we breathe in air that contains hazardous vapors, the chemicals that are absorbed through the lung lining and into the bloodstream can damage our lungs or other organs. To avoid this, auto shop technicians should wear respirators when working around petroleum products. Cartridge type respirators clean the air going into our lungs. Supplied air respirators supply clean air to the technician rather than filtering it through a cartridge. These respirators operate from high-pressure plant air systems, low-pressure pumps (must be Grade D or better), or bottled air. The air is delivered to the breathing area of the worker's hood, helmet, or face piece.

Dermal Absorption Hazards

Question
15

Hazardous materials can also enter a worker's body via skin absorption. A worker's hands may be exposed to petroleum-based products (oil, gasoline, antifreeze or transmission fluid) during repair operations.

Workers should **wear gloves** to prevent their hands from absorbing hazardous chemicals. Nitrile gloves are commonly used for handling many hazardous chemicals. Some hazardous chemicals may require use of a different type of protective glove. Always consult the material safety data sheet (MSDS) that was supplied when the chemical was purchased to determine the proper type of glove to wear when handling different hazardous products.

Workers should also wear proper **protective clothing** when exposed to hazardous materials. Some regular cloth material can dissolve when exposed to petroleum products. Other types of clothing can become flammable, act as an absorbent, or chemically react to different substances. Protective clothing should resist the intrusion of petroleum products and create a safety barrier for the technician.

Ingestion Hazards

It is possible for auto repair workers to ingest hazardous materials just through hand-to-mouth contact. To combat this, workers should always wear gloves when working on vehicles and wash their hands immediately after gloves are removed. Be aware of the hazards listed in MSDSs that may result in health problems.

Question
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Hazard Communication

“Worker’s Right to Know”

Many chemicals and other materials used in an automotive repair facility are hazardous. The Federal Hazard Communication Standard (29 CFR 1900.1200) and California’s Hazardous Substances Information and Training Act (Title 8 CCR, section 5194) speak to the dangers associated with the use of Hazardous Materials in the workplace. All users of hazardous materials should maintain the MSDSs that are included with the purchase of that material. Many Web sites that can provide the MSDS for materials that are present in the shop but that lack an MSDS.

Question
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A hazardous material is any substance capable of producing adverse effects on the health or safety of a worker. Automotive shop owner/operators are responsible for warning employees about potentially hazardous substances used in the workplace.

Hazard Communications Standard

The hazard communications process is intended to inform employees about the physical and chemical behaviors of hazardous substances in the workplace and their attendant health consequences.

Hazard communications standard components include:

- ❑ Developing and maintaining a list of hazardous chemicals present in the workplace (a chemical inventory).
- ❑ Labeling of containers of chemicals in the workplace.

Question
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- ❑ Providing worker access to materials safety data sheets.
- ❑ The development and implementation of employee training programs regarding chemical hazards and protective measures.

During a typical workday, an auto technician may be exposed to any number of hazardous materials including solvents, gasoline, paints, brake fluid, and battery electrolytes. Containers of all hazardous materials must have labels identifying their contents. ***Workers should always read the label before using any material.***

Labeling of Hazardous Materials

Question
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A typical label must identify the hazardous chemical in the product and indicate the specific hazards to using it. For example, the substance might be poisonous or flammable. The label should also outline the necessary precautions to take during product use such as wearing eye protection, gloves, or a respirator. First-aid information must also appear on the label.

Unlabeled materials can be very dangerous. Many workers have been injured because they used an unlabeled substance without knowing what it was. If a label detaches, always adhere a new one so others in the workplace know what it contains.

Labeling of Hazardous Wastes

Question
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All hazardous wastes generated in an auto repair workplace must be labeled. The label should include the contents and the date that storage began and be affixed to the container. Containers of hazardous wastes should be stored safely with other compatible wastes.

The NFPA Hazard Rating Fire Diamond

The National Fire Protection Association, NFPA, a private nonprofit organization, is the leading authoritative source of technical information, data, and consumer advice regarding fire protection, problems, and prevention. The primary goal of NFPA is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating scientifically-based consensus codes and standards, research, training, and education.

NFPA (National Fire Protection Association)
1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101 USA
Telephone: (617) 770-3000, fax: (617) 770-0700
<http://www.nfpa.org/>

NFPA has more than 300 codes. These codes, which cover every conceivable topic including basic fire safety, the *National Electrical Code*, and life safety, are developed and updated through an open review process. NFPA codes cover several aspects of flammable materials pertinent to MSDSs. Perhaps the most significant is the NFPA 704 Hazard Identification Ratings System (the familiar NFPA "Hazard Diamond") for health, flammability, instability, and special concerns.

The NFPA 704 standard provides a readily recognized, easily understood method of identifying how dangerous hazardous materials are in terms of their health affects, flammability, instability and reactivity.

The 704 rating system is applicable only to industrial, commercial, and institutional facilities that manufacture, process, use, or store hazardous materials. It is important to note that this standard is not applicable to the transportation of hazardous materials or their use by the general public. (The NFPA 704 system is often confused with the placarding required by the Department of Transportation for the transport of hazardous materials.) The 704 standard also does not apply to chronic exposure or to non-emergency occupational exposure. The objectives of the system are:

- ❑ To provide an appropriate signal or alert for the protection of both public and private emergency response personnel.
- ❑ To assist in planning for effective fire and emergency control operations, including cleanup.
- ❑ To assist all designated personnel, engineers, plant, and safety personnel in evaluating hazards.

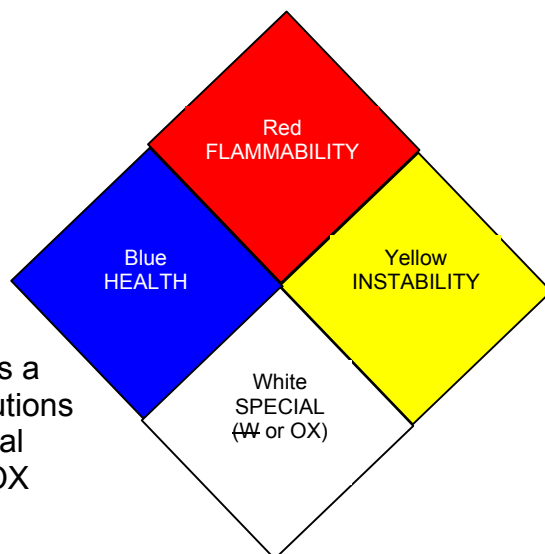
While inventorying the chemicals in the workplace for the 704 rating, consider their relative hazards. You may find that you wish to eliminate unnecessary, outdated, or unusually dangerous chemicals.

The 704 rating symbol is a "diamond shape" that identifies the severity of the health, flammability, and instability of a particular hazardous material.

Hazard severity is indicated by a numerical rating that ranges from zero (0) indicating a minimal hazard, to four (4) indicating a severe hazard. The hazards are arranged spatially as follows: health at 9 o'clock position, flammability at 12 o'clock position, and instability at 3 o'clock position. The hazards are also color-coded as follows:

- ❑ Blue for health.
- ❑ Red for flammability.
- ❑ Yellow for instability.

The 6 o'clock position on the symbol represents "special hazards" and has a white background. The two symbols that can appear in the special hazards box are a W and an OX. The W indicates a material has unusual reactivity with water and cautions against using water to control a hazardous material during firefighting or spill control response. The OX indicates that the material is an oxidizer.



While the 704 rating system is basically simple in application, the hazard evaluation should be performed by persons who are technically competent and experienced in the interpretation of the hazard criteria as set forth in the standard. Often a qualified individual can determine the ratings in a facility using the data available from the manufacturer-supplied MSDSs. The rating technique is described in NFPA 704; the actual ratings for specific chemicals are not included in NFPA 704. The user is referred to two other NFPA documents that contain hazard property information, including the NFPA 704 hazard ratings: NFPA 49, *Hazardous Chemicals Data*, and NFPA 325, *Guide to the Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids*. These documents, including NFPA 704, can be found in the *Fire Protection Guide to Hazardous Materials*.

If a rating is not available in these documents, an individual can use the NFPA 704 rating system to rate their chemical of interest. Local conditions do have a bearing on the rating of a substance. For this reason, even if your chemical is rated in one of these sources, it is recommended that you double-check the rating to ensure that your local conditions do not affect the listed rating.

Where should the NFPA 704 placards (the hazard diamond) be placed at a facility and how many placards should be used? At a minimum placards should be posted on two exterior walls of the facility, at the access point to a room or area, and/or at each principal means of access to an exterior storage area. The purpose of the placard is to provide quick hazard information for emergency responders; it should be visible wherever emergency responders are likely to enter. If there are numerous areas where responders could enter, place placards in each area. Use your best judgment to determine the placement and quantity of placards coupled with the advice of the authority that has jurisdiction over your business.

At first glance, the HMIS® (Hazardous Material Information System) and NFPA labeling systems appear quite similar. Each has four sections colored blue, red, yellow, and white. HMIS® employs colored bars, while NFPA uses colored diamonds. HMIS® attempts to convey full health warning information to all employees while NFPA targets primarily firefighters and other emergency responders.

Some employers use hybrids of the two systems. For example, they will use an NFPA hazard diamond, but the white section is used to denote both personal protective equipment (PPE) and/or special hazards. The NPCA discourages mixing the two systems in this manner. OSHA allows the use of any labeling system as long as it meets their labeling performance requirements. Thus, if you use a hybrid system at your location, you must train your employees to use the combined system and make them aware of these potential conflicts.

MSDS

The material safety data sheet (MSDS) provides detailed information on hazardous materials, including hazardous ingredients, fire and explosion data, health hazards, spill and leak response procedures, and special precautions. Federal law requires that an MSDS be accessible for each hazardous material in your workplace.

Most MSDSs contain the same basic information. They are organized into the following sections:

1. Material manufacturer and identification.
2. Hazardous ingredients.
3. Physical and chemical data.
4. Fire and explosion hazard data.
5. Reactivity data or special precautions.
6. Health hazard data.
7. Precautions for safe handling and use.
8. Control Measures.

MSDSs do have limitations:

- ❑ Not all ingredients are always listed if the percentage of a chemical is low or if trade secrets are involved.
- ❑ During use, a non-hazardous product may become hazardous due to contamination by hazardous materials. Not all MSDSs follow the same format.

Regulations

Regulations are the most complicated and confusing aspect of waste management. Compliance with federal, State and local rules governing generated wastes is of prime importance to automotive repair staff. They must be aware of types of wastes and how they are classified. The “generator” is the entity that creates the various wastes. The amount of waste generated will dictate the way in which the waste is disposed. Auto shop owners/managers must inform their regional Certified Unified Program Agency (CUPA) of all hazardous materials and activities in their shop.

In general, California hazardous waste regulations are more stringent than the federal regulations and include additional hazardous wastes that are not federally regulated. These hazardous wastes are referred to as non-RCRA (Resource Conservation and Recover Act) hazardous wastes. California hazardous waste laws and regulations are subject to change. The information contained here is as accurate as possible at the date of publication, but waste generators should check with their local regulators, the DTSC duty officer, or Web site for guidance on specific regulations.

What Are Hazardous Wastes?

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Wastes are any solid, liquid, or contained gaseous material that can no longer be used for their original intended purpose(s), and are therefore ready to be discarded. Such wastes are generally considered hazardous if they can pollute the air, water, and/or land if they are not handled or disposed of in a particular manner. State and federal environmental laws regulate the disposal of hazardous wastes.

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Determining if a Waste is Hazardous

The following procedure is recommended for determining whether or not a waste is hazardous:

1. Apply common knowledge. Most individuals recognize certain substances as hazardous without any training. For instance, most people know that lead is a toxic metal and that lead-acid batteries should not be disposed of in a trash dumpster.
2. Refer to the manufacturer's documentation. In the case of packaged products, the manufacturer's labeling should specify whether or not the contents are hazardous. The MSDS accompanying many products will also provide this information.
3. Refer to the list of hazardous wastes. The waste is hazardous if it appears on the hazardous waste list in Appendix B.
4. Have a laboratory test sample of the waste. If you are suspicious of the nature of a waste and if common knowledge, manufacturer's documentation, and the hazardous waste listing have not identified the waste as hazardous, you should have the waste tested.

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If you have a particular waste tested by a lab and continue to use this same substance and industrial process, you may apply those test results to future batches of the same waste. For example, if you test your used spray cabinet wash water and sludge once and find it to be non-hazardous, and you wash the same parts in that cabinet over time, you can assume that the sludge will continue to be non-hazardous.

Is Your Waste Hazardous?

You are ultimately responsible for determining whether the wastes generated in your shop are regulated as hazardous wastes. You can apply your knowledge of shop operations and the materials you use to determine whether a waste is regulated as a hazardous waste. If you suspect that a waste may be hazardous but are not sure, either assume that it is hazardous and pay for proper waste disposal or recycling, or have the waste lab tested to obtain a definitive determination.

Local laboratories and hazardous waste disposal companies can sample and test a waste for you using approved methods. The test results will indicate whether the waste is hazardous or not. If it is not hazardous, and if both the chemicals and process you use to generate that waste do not change, you can rely on that one

sample as proof that the waste is non-hazardous in the future. Be sure to keep a copy of each test result in your files in case a hazardous waste inspector ever questions your waste determination. Your air emissions and sanitary sewer discharges are regulated by various local, State and federal agencies.

Hazardous wastes are classified in one of two groups:

1. Characteristic hazardous waste.
2. Listed hazardous waste.

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Characteristic Hazardous Waste

A waste is classified as a characteristic hazardous waste if it exhibits any of the following characteristics:

1. **Ignitability.** The substance is easily ignited and has a flash point of less than 140°F. Examples include paint wastes (such as lacquer thinner), some degreasers (such as mineral spirits), some solvents (such as acetone), and gasoline. Ignitable wastes are assigned U.S. Environmental Protection Agency (U.S. EPA) Hazardous Waste Number D001.
2. **Corrosivity.** The substance dissolves metals and others materials, burns the skin, and has a pH of less than 2 or greater than 12.5. Examples include acids, alkaline cleaning fluids, battery acid, and some rust removers. Corrosive wastes are assigned U.S. EPA Hazardous Waste Number D002.
3. **Reactivity.** The substance is unstable or undergoes a rapid or violent change upon contact with water or other materials. Examples include airbag inflator canisters (which contain sodium azide) and electroplating bath sludges (which often contain cyanide). Reactive wastes are assigned U.S. EPA Hazardous Waste Number D003.
4. **Toxicity.** The substance is toxic as determined by a laboratory test known as TCLP (Toxicity Characteristic Leaching Procedure). Such wastes contain amounts of metals, pesticides, herbicides, or organic chemicals that would be dangerous if released to groundwater. The list of toxic contaminants contains eight metals, four pesticides, two herbicides, and 25 organic chemicals. Wastes, which are hazardous due to toxicity, are assigned U.S. EPA Hazardous Waste Numbers D004 through D043. A complete list of toxic contaminants and their waste numbers can be found in Appendix A.

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Listed Hazardous Wastes

The EPA automatically classifies a waste as a listed hazardous waste if it appears on any one of the four lists in the hazardous waste regulations. Listed hazardous wastes typically exhibit at least one of the hazardous waste characteristics described previously, or contain any number of chemicals that have been shown to be harmful to human health and the environment. The regulations list more than 400 hazardous

wastes, including wastes derived from manufacturing processes and chemicals that are thrown away. If you have doubts about whether a waste is hazardous, take action to determine the status of the waste.

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When **UNUSED** chemicals are evaluated, in addition to the characteristics, the following two lists are referenced at the U.S. EPA to determine if they are "listed wastes":

U-List (Toxics).

P-List (Acutely toxics).

U.S. EPA defines these wastes as "Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof."

When **USED** chemicals are evaluated, in addition to the characteristics, the following two lists are used to determine if the U.S. EPA regulates them:

F-List (Hazardous wastes from non-specific sources).

K-List (Hazardous wastes from specific sources).

What is an F-Listed Chemical?

A waste becomes an F-listed hazardous waste when one of the F-listed contaminants is mixed with that waste. Even one drop of an F-listed chemical on a shop rag, in an absorbent, or in used oil or antifreeze, is enough to make it a regulated hazardous waste.

Find out which products in your shop contain F-listed chemicals, and be very careful not to contaminate your wastes with them. Check the material safety data sheet for each product you use. Any aerosol or liquid solvent product (parts cleaner, brake cleaner, etc.) that contains any of the following chemicals at a concentration of 10 percent or more, and has contaminated any waste stream, must be properly managed as hazardous waste: acetone, methanol, 1,1,1-trichloroethane, methyl ethyl ketone, methyl isobutyl ketone, xylenes, benzene, ethyl benzene, toluene, perchloroethyl. See Appendix Q for a list of U.S. EPA F-listed waste codes.

Waste Generators

How Are Waste Generators Categorized?

The U.S. EPA classifies hazardous waste generators in one of three categories, depending on the quantity (weight) of hazardous wastes produced per month. However, California does not recognize all of the small quantity exemptions as in the federal regulations. For example, the table on the next page shows the requirements for obtaining a generator identification number:

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Federal Generator Category	Quantity of Hazardous Waste Generated
Conditionally exempt small quantity generator (CESQG)	220 pounds or less per month (<100 kg. Per month)
Small quantity generator (SQG)	Greater than 220 pounds (100 kg.) and less than 2,200 pounds (1,000 kg.) per month
Large quantity generator (LQG)	2,200 pounds (1,000 kg.) or more per month

Relate weight to the volume of a 55-gallon drum when determining your generator status. Water at room temperature weighs 8.34 pounds per gallon; thus, a 55-gallon drum full of water-based wastes will contain approximately 459 pounds of waste. Half a 55-gallon drum of water-based wastes slightly exceeds the 220-pound lower limit for SQG status.

What a Hazardous Waste Generator Must Do

You must follow any and all of these guidelines that pertain to your category if you have established that your shop is a hazardous waste generator:

1. Evaluate the quantity and type (RCRA or non-RCRA) of hazardous waste generated per month to determine generator status.
2. Comply with the rules that are applicable to the amount of hazardous waste produced monthly by your shop. See Appendix C for a table of generator requirements.
3. Submit a notification form to the U.S. EPA if you generate RCRA waste and are a small quantity (SQG) or large quantity (LQG) generator in order to obtain a U.S. EPA identification number for your location. Conditionally exempt small quantity generators (CESQG) are not required to register with U.S. EPA, but most will need to apply to the California Department of Toxic Substances Control (DTSC) to get a California generator identification number. The only generators exempt from obtaining a California identification number are those generating only small amounts of Universal Wastes and silver-only generators, no more than 100 kg./month.
4. Pay an annual fee, depending on your generator status and local regulations.

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What “CESQG” Means to Your Shop

You officially become a CESQG if you generate less than 100 kg. (220 pounds) per month of hazardous wastes (about 27 gallons of liquid with same weight as water). Although California regulations do not include all the exemptions, CESQGs still have fewer hazardous waste requirements to meet and a larger number of waste management options. In addition to local air pollution regulations and wastewater discharge rules, a CESQG must comply with the following basic hazardous waste management requirements:

1. Identify all hazardous waste you generate.

2. Avoid storing more than 2,200 pounds (275 gallons) of hazardous waste on-site at any one time.
3. Legitimately use, reuse, or recycle your waste on-site, or ensure delivery of your hazardous waste to one of the following:
 - ❑ A State or federally regulated hazardous waste treatment, storage, or disposal facility (TSDF).
 - ❑ A facility that legitimately uses, reuses, or recycles the waste or treats the waste prior to its use, reuse, or recycling.
 - ❑ A household hazardous waste collection center run by your State or local government, if they are permitted to accept from small businesses. There is usually a small fee for the service if available.
4. Obtain a California ID number. Most non-RCRA waste generators need a California ID number, including “milk-run” only generators. Generators of the following wastes are exempt from obtaining a California ID number:
 - ❑ No more than 100 kg. per month universal wastes (fluorescent tubes, NiCad batteries, etc., see fact sheet referenced on following page).
 - ❑ No more than 100 kg. “silver-only” waste.

The fact sheets found at the following links may help you comply with California hazardous waste laws and regulations:

Hazardous Waste Generator Requirements

http://www.dtsc.ca.gov/PublicationsForms/HWM_FS_Generator_Requirements.pdf

EPA ID Numbers

http://www.dtsc.ca.gov/PublicationsForms/OAD_FS_DutyOfficer_EPA_ID_10-02.pdf

Consolidated Manifesting

http://www.dtsc.ca.gov/HazardousWaste/HWM_FS_SB271_Gen_Req.pdf

Universal Waste

http://www.dtsc.ca.gov/PublicationsForms/HWM_FS_UWR.pdf

SOLUTIONS

Waste Reduction

The overall goal of waste reduction is to prevent pollution. Minimizing waste generation is the best approach. Recycling is the next step and should be employed to best reduce the impact on the environment.

Pollution Prevention

The *Pollution Prevention Act of 1990* established source reduction as the preferred approach to environmental protection. Pollution Prevention (P2) can save money, reduce liability, and improve efficiency, worker safety, and competitiveness. This occurs through reducing or eliminating industrial pollutants via technology transfer, education, and public awareness. Its value is as an environmental strategy, a sustainable business practice, and a fundamental principle for all of society. P2 is also a vehicle for "reinventing" traditional automotive programs and devising innovative alternative strategies to protect worker safety and the environment. It reduces risks from persistent, bio-accumulative toxic pollutants in the air, in water, and on land. P2 also incorporates environmentally preferable purchasing and corporate eco-efficiency. P2 is a building block for private sector environmental performance and sustainability.

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Waste Minimization Methods

Source Reduction Through Inventory Control

Raw materials or unused materials can become wastes if they are stored improperly, damaged in storage, or become too old to use. Inventory control is one of the easiest ways to reduce these types of losses.

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- ❑ Avoid stockpiling perishable supplies. Label, date, and inspect new materials as they are received, and use the oldest stock first. Keep dates of receipts and usage to help reduce overstock and material degradation.
- ❑ Purchase supplies in bulk and store them in bulk dispensers. This eliminates empty waste containers that may need to be disposed of as hazardous waste.
- ❑ Keep on hand only the quantities of materials that you need and use them on a "first-in first-out" basis to avoid the need to discard unopened cans when the shelf life of the material expires.

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- ❑ Consider reducing the number of brands or grades of materials you use. This will reduce the number of containers you store and reduce the risk and severity of fire or accident.
- ❑ Select suppliers who will allow you to return used materials and containers for recycling.
- ❑ Share unwanted materials.

Material and Process Substitution

Question
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You will be able to substitute non-hazardous or less hazardous materials for some hazardous materials you are currently using. Substitutions will reduce the amount and degree of hazardous wastes you generate and the harm they can cause to your workers and the environment. Newer equipment and more efficient processes will increase waste minimization.

Recycling

Question
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Recycling, reuse, and recovery of usable components are waste minimization options. Auto repair shops are required to recycle materials such as antifreeze, oil, solvents, tires, and batteries, or they must dispose of them as hazardous waste. A smaller automotive facility may save money by participating in a group contract for recycling services. Trade associations have names of shops interested in such an arrangement. Larger shops, where allowed, might purchase distillation equipment to recycle some of their waste on-site as a cost-saving measure.

Why Reduce, Reuse, and Recycle?

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The first priority is to reduce or eliminate production of any waste that is a nuisance or is hazardous. Besides being environmentally responsible, reducing wastes in your shop makes good business sense. Reduce the amount and toxicity (amount of poisons) of the wastes you generate and save money by taking the following actions:

- ❑ Reducing hazardous waste management costs.
- ❑ Reducing material costs.
- ❑ Avoiding long-term liability concerns.
- ❑ Helping to create a healthier, safer work environment.

Source reduction is not as difficult as you think. Start by walking through your shop and reviewing all of the processes that generate wastes. This will help you determine which wastes are likely to be toxic or hazardous. Ask yourself how you can modify each process so that it does not produce hazardous waste. Also, determine the cost of the used materials (solvent, paint, etc.) and the disposal cost for each waste stream. This provides economic incentive to reduce waste production. If it is not

feasible to reduce or eliminate the production of a particular waste, you might be able to reuse that waste instead and obtain additional value before it is ultimately necessary to discard it.

A number of paint and body shops find and use “dirty” mineral spirits in the initial stages of cleaning their spray guns. Fresh solvent is then used for the final rinse. The life of solvents used to clean parts and equipment can be extended by: 1) using dirty solvent to do the initial cleaning and clean solvent to do final cleaning, and 2) wiping or scraping the bulk of contaminants from parts and equipment prior to cleaning.

The final step in the waste management process is to recycle wastes whenever possible. Americans are extremely fortunate because a large and well-developed nationwide system is available for recycling many different waste materials, some of which would otherwise be a serious threat to public health and the environment. This is especially true for automotive repair wastes.

The practice of “reduce, reuse, and recycle” has a positive impact on the environment and the health and safety of workers. These practices also save money. Consider the following tips when reviewing your operation.

Substitute a Less Toxic Substance

- ❑ Switch to non-chlorinated compounds, such as citrus-based solvents, for parts cleaning.
- ❑ Use an aqueous cleaning system instead of a solvent-based parts washer.
- ❑ Always ask for a material safety data sheet when ordering any new product. The MSDS will give you valuable information about the product. Remember to keep your MSDS for future reference.
- ❑ Keep in mind that “biodegradable” does not necessarily mean environmentally safe or that the product is exempt from regulations.

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Use Sound Operating Practices

- ❑ Use funnels or pumps where possible when handling liquid products or wastes.
- ❑ Keep all product and waste chemicals in sealed containers with tight-fitting lids.
- ❑ Keep solvent rags in a closed container when not in use. Solvent from saturated rags will evaporate rapidly if left open to air. Be sure there are no free liquids in the container with the rags if they are going to a laundry service.

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- ❑ Keep lids on all solvents and turn off your solvent sink when not in use. Solvent losses due to evaporation, equipment leaks, or spills and inappropriate usage can range from 25 to 40 percent.
- ❑ Be aware that otherwise safe products that are mixed with hazardous substances (for example, chlorinated solvents) may need to be handled as a hazardous waste.
- ❑ Do not allow cleaning solutions to enter the sewer system unless you have approval from the wastewater treatment plant.
- ❑ Never discharge any waste to a street, ditch, storm sewer, stream, or the ground.
- ❑ Review the need to clean parts and the degree of cleaning necessary.

Change the Processes

Question
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- ❑ Switch to a re-circulating aqueous spray cabinet for cleaning parts instead of using solvents or hot tanks. This reduces the volume of hazardous waste that will require disposal.
- ❑ Use dirty solvent first when cleaning parts. In addition, use a filter on parts washers to extend the life of the solvent.
- ❑ Use an oil separator and water recycling system for the wash rack to reduce water usage and wastewater disposal.
- ❑ Consider switching to water-based or steam cleaners instead of using spray cans of brake cleaners, carburetor cleaner, or solvent parts cleaners.

Recycle Wastes That Cannot Be Reduced or Reused

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- ❑ Contract for a recycling service to pick up used antifreeze, lead-acid batteries, motor oil, oil filters, solvents, and scrap tires.
- ❑ Consider an on-site distillation unit to recycle used solvents.

Purchase Re-Refined Oil and Retreaded Tires /Extend Oil Drain Intervals

- ❑ Purchase re-refined oil whenever possible. Re-refining used oil consumes about 60 percent less energy than refining crude oil into lubricant quality motor oil. Thus, those who purchase re-refined oil not only extend the life of oil, but also increase our energy efficiency and decrease oil consumption.

- ❑ Purchase retreaded tires both for environmental and economic reasons. The use of retreads not only reduces the number of waste tires to dispose of, but it also reduces oil consumption. Producing a re-treaded tire consumes 2 to 3 gallons of oil, whereas producing a new tire consumes 7 to 8 oil gallons. A retreaded tire also typically costs 30 to 50 percent less than a new tire, yet it's typically covered by the same warranty. (Tire Retread Information Bureau, 2002)
- ❑ Decrease the frequency of vehicle oil changes. For the duration of a vehicle's warranty period, drain and replace used oil according to the manufacturer's warranty specifications for the particular vehicle model. Beyond the warranty period, determine oil change intervals via oil analysis. Auto shops that invest in engine oil analysis equipment can determine more precisely when engine oil is dirty enough to warrant changing.
- ❑ The standard oil change intervals recommended by oil manufacturers (every 3,000–6,000 miles) are often more frequent than necessary. Fewer oil changes conserve oil as a natural resource and reduce costs to the consumer.

Waste Management

Successful automotive waste management depends on business owners and employees working together to keep the work environment clean. They must recognize the need to establish and practice spill prevention, clean up spills appropriately, and properly manage and dispose of hazardous wastes.

Why Should a Shop Properly Manage Its Wastes?

Few of the many technological innovations of the 20th century have had as great an impact upon society as motor vehicles. Motor vehicles such as cars and trucks have created a tremendous degree of mobility, for both people and goods. Unfortunately, there is a downside to these benefits: The maintenance of motor vehicles generates a number of wastes that are nuisances and/or hazardous. These wastes can threaten worker safety, damage the environment, or put an entire community at risk if not properly handled. Liquid wastes such as used oil and antifreeze can pollute drinking water supplies and harm aquatic life if poured on the ground, down the drain, or into a trash dumpster. Other wastes such as lead-acid batteries and certain solvents can cause serious health problems if mishandled or improperly discarded.

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Your role as an automotive repair or body shop operator is vital in protecting public health and the environment. Good waste management practices are important for a number of reasons, including the following:

1. Save money by finding ways to reduce or recycle your wastes.

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2. Ensure that you are in compliance with local, State, and federal environmental regulations and avoid costly penalties.
3. Attract customers who prefer to deal with a shop that acts in a responsible manner to protect human health and the environment.
4. Join other automotive repair shops in your area that are taking pride in and benefiting a clean and healthy environment.

Practices/Efficiencies

Practicing an effective automotive fluids management program will reduce costs, paperwork, liabilities, and production of pollution. The results of these business efforts produce benefits in many ways: increased competitive advantage, profitability, and productivity; and reduction of long-term liabilities. Everyone benefits from the reduction of a negative impact on the environment.

Auto fluid management approaches should accomplish the following:

- ❑ Promote inclusion of all staff in process and rewards.
- ❑ Create an understanding and awareness of your automotive fluids waste stream.
- ❑ Disseminate information concerning automotive fluids waste minimization.
- ❑ Enhance employee communication about pollution prevention benefits.
- ❑ Establish a company policy of pollution prevention.
- ❑ Foster positive attitudes about pollution prevention.
- ❑ Identify ways to reduce or eliminate automotive fluids waste.
- ❑ Develop specific goals and target outcomes.
- ❑ Instill a philosophy of proper health and safety practices.

Participation

Everyone should understand and implement the waste handling and minimization practices adopted for the shop. Misunderstandings in how to handle waste can lead to costly accidents and hazardous waste releases to the environment. ***A shop's waste minimizing program must be integrated into all shop decisions.*** Upper-management must demonstrate support of a proposed pollution prevention program. This is crucial to its acceptance by "line" employees. Management must establish waste minimization as a top priority in the hierarchy of a company's business goals.

Input must be elicited from all levels to identify the root causes of waste and to determine processes that will eliminate it.

Keeping the Shop Clean

The following practices and equipment, when used together, significantly reduce the amount of water needed to clean shop floors. Minimization of wastewater generation reduces environmental liability and helps the shop stay in compliance with tightening regulations.

1. Prevent spills from reaching the floor.
2. Stop if there's a drop! Never walk away from a spill. If spills are not cleaned up immediately, the following can occur:
 - a. Workers can slip and fall.
 - b. Oil, antifreeze, and other spilled material can mix and be tracked around the shop and into vehicles.
 - c. More time and money will be spent washing the floor.
3. Mechanics should carry rags so that small spills can be wiped dry when they occur. Never saturate rags with liquids. Waste haulers may not pick up rags with "free liquid." Always use enough rags to prevent saturation.
4. Use the "4-step method" to clean up spills:
 - a. Use a "hydrophobic" mop to pick up oil from any spill.
 - b. Use "dedicated" mops (that is, one for coolant, another for oil, and a third for wash water).
 - c. Use shop rags to pick up residual liquid.
 - d. Wet mop, if necessary, with a mild non-caustic detergent as a final cleanup. Empty the wash water into the sanitary sewer through a sink or toilet, never into storm drains.
5. Cleanup equipment should be well marked for easy accessibility, because a medium-sized or larger spill might occur. You can attach red flags to mop buckets used for spill cleanup so workers can easily locate them. Keep all spills out of sewer drains.
6. Sweep your floor with a broom every day to prevent unnecessary dirt and contaminant buildup.
7. Never hose down the work area! This practice generates large quantities of contaminated wash water that might be discharged to a sewer, or worse, flushed out of the shop to a storm drain.

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8. Be sure the wash water is disposed of properly if a pressure washer is used to clean your floors. The shop is responsible for proper management of the wash water and can be held liable for its illegal disposal, even if a contractor performs pressure washing. The best way to avoid this liability and the costs associated with pressure washing is to clean up spills when and where they occur.

Sealing the shop floor with epoxy or other suitable sealant can be expensive (typical cost for epoxy sealing is \$1.50 to \$2.00 per square foot), but epoxy sealing produces the following benefits:

- ❑ Won't absorb spills as a concrete floor does.
- ❑ Makes spill cleanup easier. (Squeegee small spills into a dustpan and pour liquid into appropriate drum.)
- ❑ Requires less time and water to clean.
- ❑ Lasts for years and reduces long-term liability for cleanup of a contaminated shop floor and soil below.
- ❑ Looks great to customers and workers alike.

Storage

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Store all hazardous liquids in covered containers to prevent evaporation, spills, and contamination. All storage should be in a locked, roofed, or covered indoor area with a concrete floor and curbs for spill containment. Organize storage areas with enough room for easy and safe access. Help minimize spills and accidents by providing proper aisle width and safe stack height. Inspect the storage area at least once a month for leaky containers, spills, leaks, and out-of-date supplies.

Spill Control

Reduce spills by using a gravity spigot or pump to dispense bulk liquid materials. Always use a spout and funnel when transferring liquids. Keep the lids on containers at all times except when in use.

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Check with your sewer utility to find out where your drains lead. Most outside drains and some inside drains do not go to a sewage treatment plant, but instead are storm drains that lead directly to a stream, lake, ditch, or dry wells. If you discharge contaminated water into any of these you may pollute surface and/or groundwater, resulting in significant fines.

Spill Prevention Equipment

Use Secondary Containment of Used Oil and Waste Antifreeze

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- ❑ Use secondary containment to capture liquid spills and leaks.
- ❑ May use inexpensive troughs used for livestock, find at local agricultural feed stores.
- ❑ Pump out fluids for use or recycling.
- ❑ Mark clearly all stored materials.
- ❑ Inspect troughs daily for leaks.
- ❑ Keep troughs clean and dry.

Funnel Drum Covers

- ❑ These minimize spills when transferring liquids from one container to another.
- ❑ They can be used to drain oil filters.

Bulk, Pressurized, Overhead Fluid Delivery

- ❑ Available from all major motor oil manufacturers.
- ❑ Used to reduce spills in oil changes and lube jobs.
- ❑ Allows these jobs to be done more quickly.
- ❑ Oil manufacturer often provides equipment at no charge.

Wastewater Contamination

Prevent leaks and spills to avoid contaminating the water used during floor wash-downs. You may not need to monitor wastewater discharges if all leaks and spills are contained and can be cleaned up without a discharge of wastewater to the sanitary sewer or storm drain. Use procedures and equipment that recycle rinse and wash water. If you do not dump each batch of rinse water to the sewer, you may not have to install costly wastewater pretreatment equipment.

Collect leaking or dripping fluids in drip pans or other containers. Keep a drip pan under the vehicle while you unclip hoses, unscrew filters, or remove other parts. Use a drip pan under any vehicle that might leak while you work on it to keep splatters or drips off the shop floor. Promptly transfer captured fluids to the proper waste or

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recycling drums. Don't leave partially full drip pans or other open containers unattended.

Drain and replace motor oil, coolant, and other fluids in a designated area of the shop, where the storm and/or sanitary sewer floor drains are protected. Clean up minor spills before they reach the drains.

Collect all spent fluids, store them separately, and have them picked up by a recycler. The fluids may have to be disposed as hazardous wastes, with associated high costs, legal liabilities, etc. if you do not recycle. Store used liquids as hazardous wastes. (Check with your fire department about storage requirements for hazardous materials and wastes.)

LIQUID WASTE

In Vehicle Usage

Liquids drained from vehicles make up much of the waste generated in an automotive shop. This section deals with the problems associated with used oils such as motor and transmission fluids. Also addressed are engine coolants, brake fluid, and fuels. Following are some proposed solutions to these problems.

Used Oil

“Used oil means any oil that has been refined from crude oil, or any synthetic oil, that has been used, and, as a result of use or as a consequence of extended storage, or spillage, has been contaminated with physical or chemical impurities.” (Health and Safety Code [HSC] 25250.1.) Used oil is the largest volume hazardous waste generated in California. Improper management of petroleum products can result in major environmental damage. Oil is a mixture of hydrocarbon fractions, C2 to C14 aliphatic chains and a small amount of aromatic compounds.

Used oils include, but are not limited to, the following:

Used motor oils:

- Vehicle crankcase oils.
- Engine lubricating oils.
- Transmission fluids.
- Gearbox and differential oils.

Used industrial oils:

- Hydraulic oils.
- Compressor oils.
- Turbine oils.
- Bearing oils.
- Gear oils.
- Transformer (electrical) oils.
- Refrigeration oils.
- Metalworking oils.
- Railroad oils.

Used oil does NOT include:

- Antifreeze.
- Brake fluid.
- Other automotive wastes.
- Fuels (gasoline, diesel, kerosene, etc.).
- Grease.
- Solvents.

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Substances that are not oils.
Oils with a flashpoint below 100°F.
Oils containing more than 1,000 parts per million (ppm) total halogens unless the *rebuttable presumption is rebutted*—See Appendix G.
Oils mixed with hazardous waste.
Wastewater containing small amounts of used oil.
Oils containing five ppm polychlorinated biphenyls (PCBs) or greater.
Oily wastes that are not used oil.
Oily wastewaters that are not used oil.
Tank bottoms.
Used oil processing bottoms.
Used oil re-refining distillation bottoms.
Cooking oils (edible).
Edible oils that are used for industrial purposes and that do not exhibit a hazardous characteristic.

The term "used oil" includes the following:

- ❑ Spent lubricating oil that has been removed from equipment or machines.
- ❑ Engine oil: typically crankcase oils from automobiles, trucks, etc.
- ❑ Transmission fluid.
- ❑ Spent industrial oil.
- ❑ Contaminated fuel oil.

Problems

Environmental Impact

Used oil contains many toxic and environmentally harmful substances (for example, cadmium, chromium, lead, benzene, toluene, benzo pyrenes, etc.). These are present through use as a lubricant and the inadvertent contamination of the oil during vehicle servicing and bulk handling.

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Worker Safety

The benzene-based aromatic components in oil can cause cancer and other health problems if the oil is inhaled or ingested.

Regulations

Used oil must be managed as a hazardous waste in California unless it is shown to meet one of the specifications for recycled oil in HSC section 25250.1 or qualifies for a recycling exclusion under HSC section 25143.2. This means in most instances that

the generator will contract with a registered hazardous waste transporter to have used oil picked up within the appropriate accumulation period. The accumulation period is 90 days for large quantity generators or 180 days for generators of less than 2,200 lbs. of hazardous waste per month (270 days if the generator sends the oil to a used oil facility that is more than 200 miles away) California Code of Regulations (CCR) section 66262.34. The transporter must take the oil to an authorized used oil storage or treatment facility. Among the facilities are used oil recycling operations where the used oil is processed into recycled oil or re-refined into high-class lubricant.

Mixing of hazardous waste, including household hazardous waste, with used oil is prohibited. Federal regulations mandate that used oil must be tested to determine if the used oil is hazardous before it is disposed. If it is determined that the oil is hazardous through testing or other procedures, it must be disposed of as a hazardous waste under Subtitle C of RCRA (Resource Conservation and Recovery Act).

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In California used oil is regulated as a hazardous waste:

"Used oil shall be managed as a hazardous waste in accordance with the requirements of this chapter until it is excluded from regulation as a hazardous waste pursuant to Section 25143.2" (from Calif. HSC section 25250.4).

The following definitions are from Calif. HSC section 25250.1(a) and Title 14 CCR Natural Resources Div. 7(IWMA Chapter 8):

1. **"Used oil,"** means any oil that has been refined from crude oil, or any synthetic oil, that has been used, and, as a result of use or as a consequence of extended storage, or spillage, has been contaminated with physical or chemical impurities. Examples of used oil are spent lubricating fluids which have been removed from an engine crankcase, transmission, gearbox, or differential of an automobile, bus, truck, vessel, plane, heavy equipment, or machinery powered by an internal combustion engine; industrial oils, including compressor, turbine, and bearing oil; hydraulic oil; metal-working oil; refrigeration oil; etc.
2. **"Recycled oil,"** means any oil, produced from used oil, which has been prepared for reuse and which achieves minimum standards of purity, in liquid form, as established by the CIWMB.

Calif. HSC section 25250.5:

- a. The disposal of used oil by discharge to sewers, drainage systems, surface water or ground water, watercourses, or marine waters; by incineration or burning as fuel; or by deposit on land, *is prohibited*, unless authorized under other provisions of law.
- b. The use of used oil or recycled oil as a dust suppressant or insect or weed control agent is prohibited unless allowed under another applicable law, but only to the extent that use as a dust suppressant or insect or weed control agent is consistent with the federal act.

Used oil removed from motor vehicles and recycled is excluded from generator fees. Used oils that do not qualify for the exclusion usually will be subject to generator fees.

Used Oil Generator Requirements

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Persons or businesses generating used oil are required to meet all used oil generator requirements. Used oil collection centers must meet the same requirements as per the CCR sections 66279.20 and 66269.21. Householders who change their own oil (do-it-yourselfers) are exempted from regulation as used oil generators. They must, however, manage their used oil appropriately (for example, by taking it to a used oil collection center, etc., and never disposing of it to land, water, storm drains, etc.)

Householders are allowed to transport their own used oil to a used oil collection center or to a used oil recycling facility if specified conditions are met. These conditions are described in HSC section 25250.11. Some communities have a curbside used oil pickup program. Check with your local solid waste or environmental health agency to see if it is offered in your area.

Each site where used oil is stored is required to have a United States Environmental Protection Agency (U.S. EPA) identification number issued by the Department of Toxic and Substances Control (DTSC). A generator who stores used oil in two places at the same site needs only one U.S. EPA identification number.

Used oil must be stored in tanks or containers in good condition. Tanks and containers must be made of non-earthen, non-absorbing, rust-resistant material such as steel or oil-resistant plastic, and have adequate structural support to contain the used oil. "Good condition" means no severe rusting, no apparent structural defects or deterioration, and no leaking. All containers must have tight-fitting lids that are kept closed except when used oil is being added or removed. Regular inspections and routine maintenance of all storage tanks and containers are required. Faulty tanks and containers must be repaired or replaced. Definitions of container and tank are given in CCR section 66260.10; general information may be found in CCR section 66262.34(a)(1).

Secondary containment, required for storage tanks, is a backup containment system designed to prevent the release and migration of wastes or accumulated liquids out of a storage tank or a storage tank system. Secondary containment systems include an impervious bermed area or liner, a vault, or a double-walled tank as per CCR section 66262.34(a)(1).

Above-ground storage tanks and containers accumulating used oil, and fill pipes used to transfer used oil into underground storage tanks, must be labeled with the words, "USED OIL—HAZARDOUS WASTE," and the initial date of accumulation. In addition, containers must be labeled with the name and address of the generator as per CCR sections 66262.34(f). For shipping, containers must also be labeled as listed below.

HAZARDOUS WASTE: State and Federal Law Prohibit Improper Disposal. If found, contact the nearest police or public safety authority, the U.S. EPA, or the California Department of Health Services.

- ❑ Generator's name and address
- ❑ Proper Department of Transportation (DOT) shipping name
- ❑ Generator's EPA Identification Number
- ❑ Uniform Hazardous Waste Manifest number and the shipping identification number

Additional requirements for used oil generators are contained in the Health & Safety Code and 22 California Code of Regulations provisions.

Solutions

Waste Reduction

Conservative oil changes should be encouraged and implemented. Lubricants should be changed when worn out. A good understanding of the lubricant's life by the customer and repair facility could reduce unnecessary oil usage. Maintaining gaskets and seals is very important in order to prevent leaks.

Question
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Recycling

Finding uses for recycled oil will protect the environment and conserve a natural resource. It is estimated that more than 100 million gallons of used oil is recycled each year in California. Used oil can be collected, re-refined, and used over and over again.

Used oil can be recycled as:

- ❑ Reconditioned oil that is re-used on-site by removing impurities from used oil and reusing it. While this form of recycling might not restore the oil to its original condition, it does prolong its life.
- ❑ Recycled oil that is delivered to a petroleum refinery and is introduced as a feedstock at the front end of the petroleum refinery process.
- ❑ Bunker fuel used in ships at sea.
- ❑ Re-refined oil: this is used oil that has been cleansed of metals and impurities and meets the same American Petroleum Institute standards for lubricating oil as virgin oil derived from crude stock.

Question
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Re-refining prolongs the life of the oil resource indefinitely. This form of recycling is the preferred option because consumers close the recycling loop by reusing the same oil again and again.

- ❑ Oil is processed, involving the removal of water and particulates, so that used oil can be burned as fuel to generate heat or to power industrial operations. This form of recycling is not as preferable as methods that reuse the material because it enables the oil to be reused only once.

Waste Management

Question
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Mixing used oil with other hazardous waste is not allowed. The contamination of used oil with other characteristic or listed waste (such as chlorinated solvents) will cause the entire mixture to become hazardous. Shop work practices must ensure that hazardous waste does not come in contact with used oil intended for recycling. Halogenated solvents are the most common listed contaminants found mixed with used oil.

Storage

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Label all containers and tanks as "Used Oil." Keep containers and tanks in good condition. Don't allow tanks to rust, leak, or deteriorate. Store used oil in areas with oil-impervious flooring and secondary containment. Used oil is usually stored in above-ground containers. Tanks and/or containers of used oil should be placed in a weatherproof area, and should be kept away from incompatible materials. These containers must have some form of "secondary containment." This includes the containers being placed on concrete or asphalt pads with berms to prevent the spread of a spill, or inside another container such as a metal trough or larger tank. It should not be accessible to unauthorized personnel. All used oils included in the definition of used oil may be stored together (check with your contracted recycler for direction).

Transporting Used Oil

In general, California law requires that a registered hazardous waste transporter be used to transport used oil. However, in a few instances the use of a registered hazardous waste transporter is not required. These are as follows:

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Householders and conditionally exempt small quantity generators are allowed to transport up to 55 gallons of used oil per trip to an authorized used oil collection center if the oil is carried in containers that hold 55 gallons or less and specified conditions are met. Authorized used oil collection centers include certified used oil collection centers (Public Resources Code section 48622), recycle-only household hazardous waste collection facilities, or collection facilities operating pursuant to HSC 25250.11. If specified conditions are met, mobile maintenance operations (see below) may transport up to 55 gallons of used oil in any one vehicle at any one time from an off-site location to a consolidation point.

When a registered hazardous waste transporter transports used oil, either a full hazardous waste manifest or a modified hazardous waste manifest must be used. When a modified hazardous waste manifest is used, the driver is required to provide the generator (at the time of used oil pickup) with a legible copy of a receipt for each quantity of used oil received. The generator must maintain these receipts for three years. Each receipt must contain the following information:

- ❑ Generator's name, address, U.S. EPA identification number (if applicable) and telephone number.
- ❑ Generator's signature or signature of generator's representative.
- ❑ Date of shipment.
- ❑ State manifest number (pre-printed on the manifest).
- ❑ Volume and shipping description of each type of used oil received.
- ❑ Name and address of the authorized facility to which the used oil is being transported.
- ❑ The transporter's name, address, and identification number.
- ❑ The driver's signature.

The statute also requires the generator to provide a signed waste minimization statement. The statement certifies that the generator has established a waste minimization program to reduce the volume or quantity and toxicity of the waste as much as is economically practicable. In the case of used oil generated by routine vehicle or equipment service, the generator is not required to reduce the used oil generation. But for waste oils generated through equipment leaks or processes that could be made more efficient, the generator should have a plan to reduce the generation of the waste.

Mobile Maintenance Operations

Maintenance businesses that generate used oil in the performance of routine maintenance operations at off-site locations are subject to special requirements. Such businesses include off-site heavy equipment operations (for example, construction vehicle fleets) and mobile oil-changing businesses providing oil changes for personal and business vehicles at the customer's location (HSC 25250.12). The following requirements apply:

- ❑ The owner/operator of the mobile maintenance business must have a point of consolidation for the used oil. The point of consolidation can be either at the maintenance business location or at a separate location owned by another person, such as a service station.

- ❑ The maintenance business must have an U.S. EPA ID number. When a separate location is used for consolidation, both the maintenance business and the separate location must have U.S. EPA ID numbers.
- ❑ The point of consolidation must be at a non-residential location.
- ❑ The transport vehicle must be owned by the business or by an employee of the business.
- ❑ The business is not required to register as a hazardous waste transporter as long as they transport no more than 55 gallons of used oil from off-site location(s) to the point of consolidation at any one time.
- ❑ The used oil is deemed to be generated at the point of consolidation upon consolidation.
- ❑ The used oil must be handled and stored at the point of consolidation in accordance with all applicable hazardous waste laws.
- ❑ A registered hazardous waste transporter must transport the consolidated used oil from the point of consolidation to a permitted used oil recycling facility.

Miscellaneous

Question
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It is unlawful to dispose of used oil on land, to sewers and other water systems, or to burn used oil as a fuel or by incineration, including in space heaters and similar devices. The use of used oil as a dust suppressant (road oiling) or for insect or weed control is prohibited (HSC 25250.5).

Generators of used oil who also operate used oil collection centers, such as service stations, are advised not to mix the used oil generated in their business with the used oil from the collection center. The rebuttable presumption is not deemed rebutted if used oil from householders or conditionally exempt small quantity generators has been mixed with used oil from other sources.

Motor Oil

Modern motor oils are based upon oil refined from crude petroleum, synthetic oil created from various compounds, or a mixture of the two. Various compounds are added to the oil to extend its range of operating temperatures, to keep solids in suspension, and to discourage the formation of varnish and other deposits. All motor oils eventually become contaminated through use with substances that are a threat to the environment regardless of the oil base and additives. Used motor oil often contains traces of fuel and antifreeze, along with the products of internal wear: chromium, copper, lead, zinc, and other metals.

Motor oil is designed to reduce friction, seal piston rings, and cushion, cool, and clean engine components. It contains additives and cleaning agents designed to aid in these processes. These are proprietary to the various oil manufacturers. When the oil has lost its effectiveness due to being worn out or contaminated, it must be changed by draining it from the engine. It must be managed so that it does not pollute the environment.

Sources of Contamination:

1. The heat of engine operation can chemically alter additives and oil constituents.
2. Exhaust gases bypass worn piston rings and enter into the engine's lubricating oil.
3. Fluids, such as water and antifreeze, can leak into the oil during engine operation.
4. Wear and chemical reactions cause heavy metal residues to dissolve in the engine oil.
5. Contaminants enter during vehicle servicing and/or the transfer of oil between containers.

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Sampling of California Statistics

- ❑ One in four households have a do-it-yourself (DIY) oil changer.
- ❑ Each year about 40 million gallons of automotive oil is sold to the public.
- ❑ About 2,700 State-certified collection centers and 70 curbside collection programs accept used oil at no charge.
- ❑ About 82 million gallons of used oils were recycled in 1998.
- ❑ Over 20 million gallons of used motor oil is disposed each year in an unknown manner in California by do-it-yourself oil changers. This equates to nearly 1 gallon of DIY used oil improperly disposed of for every adult.

Question
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Problems

Environmental Impact

Used motor oil poses a very serious problem when it enters the environment. It often soaks into the ground, where it slowly mixes with rainwater, leaching through the ground into the water table. It is difficult for a public works treatment to clean this contaminated water to the degree necessary for human consumption. Pouring 1

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gallon of used oil on the ground can ultimately cause 1 million gallons of water to become undrinkable, according to U.S. EPA studies.

Motor oil imparts toxicity to water it contaminates, prevents oxygen from dissolving in the water, and make the waters unattractive and undrinkable. Collection and storage of engine oil must not be allowed to endanger an area's water supplies. Be sure that used oil storage is not exposed to rain! Storm water runoff containing oil must be controlled so it does not contaminate water running into the stormwater or sewer systems.

Sampling of General Facts:

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- ❑ 2.7 billion gallons of oil are sold annually in the U.S.
- ❑ 50 percent of oil is consumed and 50 percent becomes used oil; 31 percent of the used oil, or about 420 million gallons, is never recycled! Much of it goes into the environment.
- ❑ Used motor oil can contain toxic substances such as benzene, lead, zinc, and cadmium.
- ❑ The oil from a single oil change (1 gallon) can ruin the taste of a million gallons of drinking water (1 part per million), the supply of 50 people for one year.
- ❑ 1 pint of oil can produce a slick of approximately 1 acre on the surface of water.
- ❑ Films of oil on the surface of water prevent the replenishment of dissolved oxygen, impair photosynthetic processes, and block sunlight.
- ❑ Crankcase oil accounts for more than 40 percent of total oil pollution of the nation's harbors and waterways.
- ❑ Oil dumped on land reduces soil productivity.
- ❑ Concentrations of 50 to 100 parts per million (ppm) of used oil can foul sewage treatment processes.
- ❑ Countries all over the world, including South Africa, Israel, Pakistan, India, Canada, Great Britain, France, Italy, and New Zealand, re-refine a larger fraction of used oil into lubricating oil base stocks than the U.S.
- ❑ Of the more than 1.3 billion gallons of used oils generated each year in the U.S., less than 60 percent is recycled.

- ❑ Used oil is recycled by burning or refining it for energy or re-refined. Burning oil results in air pollution that includes sulfur and hydrocarbon emissions.
- ❑ 3 to 5 percent of the used oil that is re-refined ends up as hazardous waste sludge.

Worker Safety

Engine oil is generally very hot when removed from an engine. Burn prevention should be stressed in the automotive shop setting. Spills should be cleaned up immediately to prevent slipping.

Regulations

“Prohibition of and liability for discharge of substances deleterious to aquatic habitat, into the state's water.” (Section 5650 and 12016, Calif. Fish & Game Code.)

Solutions

Waste Reduction

For the duration of a vehicle's warranty period, drain and replace used oil according to the manufacturer's warranty specifications for that particular vehicle model. Beyond the warranty, determine oil change intervals through oil analysis. The standard oil drain interval recommended by oil manufacturers is often far more frequent than is actually necessary. In Europe, the recommended oil drain interval for most automobiles is every 10,000 miles as compared to the standard recommended U.S. interval of every 3,000 to 6,000 miles.

Oil Life Extension

Why Test Your Engine Oil?

Fleet maintenance facilities generate a tremendous amount of used oil from routine engine maintenance. Engine oil changes are typically performed according to mileage or calendar schedules that are based on average data for a wide variety of vehicles. As a result, engine oil changes are often performed more frequently than necessary. You are purchasing and throwing away more oil than you need to if this is the case at your facility.

Advantages of Oil Testing

1. *Resource Conservation.* Oil is a non-renewable resource; oil supplies are decreasing, which will drive prices higher. You can help save this nonrenewable resource by extending engine oil life through testing!
2. *Source Reduction.* Reduce oil change frequency through testing and you reduce used oil generation at the source.

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3. *Cost Savings.* Extending oil life reduces oil purchase and disposal costs as well as labor spent on changing oil.
4. *Monitoring Maintenance Practices.* You can identify trends, after a few tests, to verify that routine maintenance is performed adequately.
5. *Keeping Minor Repairs Minor.* Testing provides early warning of engine component problems before they become serious, which will:
 - Reduce repair costs.
 - Help you anticipate vehicle down time.
 - Minimize “hit and miss” disassembly and inspection.

Bypass Oil Filter

What is a Bypass Oil Filter?

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A bypass oil filter is an added system designed for use in conjunction with a full flow oil filter. Some bypass oil filters remove solid particles down to as small as one micron. Some bypass oil filters can also remove liquid contaminants such as fuel, water, and antifreeze.

What Does a Bypass Oil Filter Do?

A bypass filter, similar to a full flow oil filter, uses a replacement or reusable filter for filtering contaminated oil. A bypass filter has the capability to remove finer abrasive particles and soot, along with liquids and oxidation by-products known as gum and/or varnish.

A very small amount of oil from the main oil galley is directed through a bypass filter and returned to the oil sump. A bypass filter has a metering jet, orifice, or check-ball that prevents any drop in oil pressure and also slows the oil flow down to a low, measured flow rate of 3 to 8 gallons per hour.

Why Use a Bypass Oil Filter?

Internal combustion engines require that oil maintain the proper viscosity and total base number (TBN) in order to perform at peak efficiencies. A bypass filter can provide a constant cleaning process that safely extends oil change intervals, reduces need of new oil, reduces disposal costs of waste oil, and helps extend engine life and efficiency.

Oil drain intervals can be dramatically extended or possibly eliminated by keeping the oil constantly clean, maintaining the intended viscosity, and enabling the oil to provide maximum lubricating and cooling qualities.

Why Sample Oil?

Sample the oil before it enters a bypass filter. This provides an accurate assessment of the condition of the oil and the equipment. It has been determined that the most effective preventative maintenance schedule for engines and other equipment is

changing the full flow and bypass filter elements, and performing an oil analysis at the original equipment manufacturer's specified oil change intervals. The oil does not need to be changed as long as oil analysis confirms that it is suitable for continued use.

Lubricating oil does not wear out. It will maintain its lubrication qualities intact almost indefinitely if kept clean.

End-users with a bypass filtration system have reported cost savings up to 90 percent on both oil purchases and oil disposal.

Sampling of Interesting Facts

The Cal/EPA Department of Toxic Substances Control certified the puraDYN™ Oil Filtration System in 1994 as "A Pollution Preventing Technology." In 1998, they recertified the puraDYN™ Bypass Oil Filtration System. They stated, "...an effective means of extending engine oil change intervals through the removal of particulates, water, and dissolved fuel. Extension of drain intervals reduces: 1) use of new oil, 2) generation of used oil, and 3) potential of spills while draining and transporting used oil." They went on to say that, "If properly operated, monitored and maintained, the puraDYN™ Bypass Oil Filtration System maintains the following engine oil properties within acceptable limits for continued use: viscosity and solids content, water, coolant, fuel, wear metals, and oil additives."

Vendor Contact Information

PuraDYN Filter Technologies Inc. (800) 488-0577 www.puradyn.com/
PureCycle Filters (888) 989-1599 www.purecyclefilters.com/

Recycling

You can protect the environment and conserve a natural resource by finding uses for recycled oil. It is estimated that over 100 million gallons of used oil are recycled each year in California. Used oil can be collected, re-refined, and used over and over again. Used motor oil is valuable and has several uses, as a result there are well-established systems for collecting and processing it. Most of the used oil collected in this country is cleaned and sold as fuel for various industrial processes. A small percentage is recycled to produce new motor oil and other lubricants. The oil itself does not wear out; it can be filtered to remove solids, and then refined to remove other contaminants such as water, gasoline, and diesel fuel. The resulting oil is combined with new additives as needed to produce a fresh product.

What Is Re-Refined Oil?

It is used motor oil that undergoes an extensive re-refining process to remove contaminants, such as dirt, fuel, water and additives, to produce good-as-new base oil. This base oil is then sold to blenders who combine it with additive packages to produce lubricants such as motor oil, transmission fluid, and grease. The key is that base oil does not wear out; it can be recycled over and over again. The main

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difference between use of re-refined and virgin oil products is that re-refined oil use represents the most responsible choice for the environment.

Are Re-Refined Lubricants Safe to Use?

- ❑ Re-refined oil is subject to the same stringent refining, compounding, and performance standards as virgin oil.
- ❑ Lubricants made from re-refined base stocks must undergo the same testing and meet the same standards as virgin lubricants in order to receive the American Petroleum Institute's (API) certification.
- ❑ Vehicle and engine manufacturers such as Mercedes Benz, Ford, General Motors, Chrysler, and Detroit Diesel have issued warranty statements that allow the use of re-refined oil as long as it meets API standards.
- ❑ Many government and private fleets have used re-refined lubricants in their vehicles for years and report no difference in performance of virgin lubricants.
- ❑ There is no compromise in quality with re-refined oil.

Why Recycle Used Oil?

- ❑ Motor oil never wears out (can be recycled, cleaned, and used again).
- ❑ Conserves a natural resource.
- ❑ Good for the environment.
- ❑ Reduces pollution threat.
- ❑ Get paid for recycling.
- ❑ Reduce dependence on imported oil.
- ❑ Re-refining is energy efficient.
- ❑ Help reduce our trade deficit.
- ❑ Provide jobs.

Re-Refined Oil Facts

- ❑ 2.5 quarts of re-refined lubricating oil can be produced from 1 gallon of used oil.

- ❑ Re-refining is energy efficient—less energy is required to produce a gallon of re-refined base stock than to produce a base stock from crude oil.
- ❑ Re-refined oil prices are competitive with equivalent virgin oil products.
- ❑ Mercedes Benz installs re-refined oil in every new car manufactured.
- ❑ Re-refined oils meeting the American Petroleum Institute (API) Standards meet warranty requirements for new automobiles.
- ❑ For 1999 and 2000, the California Department of General Services purchased approximately 200,000 gallons of lubricants with re-refined oil base stock.
- ❑ The U. S. Postal Service and National Park Service use re-refined oil in their vehicle fleets.
- ❑ If the oil generated by all do-it-yourself oil changers in America were collected and re-refined, it would provide enough motor oil for more than 50 million cars each year. This would reduce our dependence on imported oil, help reduce our trade deficit, and provide jobs.
- ❑ By using re-refined oil, the recycling loop is closed.
- ❑ The Department of Defense compared making lube oils from virgin base oil to used oil and determined the use of used oil to be more environmentally friendly and cost effective.
- ❑ The U.S. Conference of Mayors has endorsed re-refined oil.

Get Paid For Recycling

You are considered an industrial generator of used oil if you own or operate equipment that generates used oil. You can receive a 16 cents per gallon recycling incentive for all the used oil generated by your equipment if you become a registered industrial generator.

Curbside collection programs that pick up used oil may also become registered with the State. Once registered, program operators can receive the 16 cents per gallon recycling incentive for all the used oil collected at curbside as well as used oil generated by program vehicles.

Private businesses, local governments, or special districts may become registered industrial generators or registered curbside collection programs. The California Integrated Waste Management Board (CIWMB) administers the Industrial Generator Registration Program. For more information and a registration application, visit

www.ciwmb.ca.gov/UsedOil/Generators/Register/ or call the Used Oil Recycling Program at (916) 341-6457.

Waste Management

Question
72

Catch engine oil in containers when it is removed from a vehicle. Keep used engine oil in a container marked "Used Oil Only." Place the container in a secure area. Don't mix your used engine oil with any other waste except used ATF and gear oils. Don't accidentally contaminate used engine oil by mixing it with even small amounts of brake cleaner, carburetor cleaner, or other wastes.

DO

1. Keep used oil in a separate container, clearly marked "USED OIL ONLY."
2. Contract with a used oil transporter/recycler that is registered with the U.S. EPA and has a U.S. EPA ID number. Evaluate transporters for service, compliance with environmental regulations, and proof of current liability insurance.
3. Obtain a receipt or bill of lading showing the amount of oil shipped off-site, and retain records for three years.
4. If recycling is not available, have used oil tested to ensure that it is non-hazardous.

DO NOT

1. Mix used oil with even small amounts of hazardous wastes or solvents, such as brake cleaner or carburetor cleaner. This could contaminate the entire container of used oil, making it a hazardous waste.
2. Pour used oil onto the ground (even for dust suppression) or dispose of used oil in a storm drain, septic tank, dry well, sewer, or dumpster.
3. Deliberately mix used oil with other solid wastes destined for a landfill.

Automatic Transmission Fluid

Question
73

Transmission fluid is a petroleum-based product containing additives and a red dye. Transmission fluid is typically managed the same as used motor oil. Automatic transmission fluid (ATF) is typically mixed into the waste oil the shop is collecting for recycling. Check with your service provider as how to proceed.

Problems

Environmental Impact

Transmission fluid is oil-based and can become contaminated during use and/or repairs. It is imperative that petroleum-based fluids, chlorinated solvents, and heavy

metal contaminants not enter the water supply. You need to protect your waste automotive fluid storage area from exposure to rainwater and the resulting runoff into the stormwater drain or sewer system. Call the local waste treatment facility for answers to your questions concerning stormwater runoff or discharging to the sewer.

Transmission fluid should not be dumped into septic systems, gutters, storm drains or onto the ground. Used transmission fluid judged to be a hazardous waste cannot be released into the sanitary sewer or storm drains!

Worker Safety

Same issues apply to transmission fluid as to engine oil.

Regulations

The California requirements for the management of used oil can be found in Article 13, Chapter 6.5, Division 20, of the HSC. The federal (U.S. EPA) regulations for used oil are detailed in 40 CFR Part 279.

Solutions

Waste Reduction

The same issues apply to waste transmission fluid as engine oil.

Recycling

Used transmission fluid can be reconditioned and reused (recycled) by filtering and removing contaminants from it. All petroleum-based products, such as transmission fluid, can be exempted from hazardous waste regulations if they have not been contaminated by other wastes (such as heavy metals and/or solvents), and are recycled. Automatic transmission, power steering fluids, and lubricating oils share similar pollution prevention prospectives and should be managed and recycled in the same manner.

Waste Management

Catch ATF in containers when the transmission is removed from a vehicle. An automatic transmission drained and removed from a vehicle can still contain several quarts of ATF. Don't let the transmissions sit on the ground (or shop floor) for extended periods of time, or be moved within the shop, without some type of oil catch containment. Use one dedicated area in your shop for the disassembling of transmissions, on a sloped, metal bench that drains to a used ATF container.

Keep used ATF in a container marked "Used Oil Only." Place the container in a secure area. Don't mix your used ATF with any other waste except used oil. Don't accidentally contaminate used ATF by mixing it with even small amounts of brake cleaner, carburetor cleaner, or other wastes.

Engine Coolant

The majority of cars use a liquid cooling system that circulates a liquid around hot engine parts and carries off the heat. The liquid is called a coolant. The system used to be referred to as a water-cooled system because the coolant in older automobiles was primarily water. Water causes the formation of rust in the water jackets, which acts as a barrier to heat transfer. As a result, all modern cars used a coolant composed of water and additional substances. The most common name for modern coolant is antifreeze. Antifreeze is a substance that is added to a liquid; usually water, to lower its freezing point. Nearly all of the currently produced antifreeze is manufactured with ethylene glycol and methyl alcohol, although various substances have been used in the past. More than 95 percent of the antifreeze on the market is "permanent" antifreeze, containing ethylene glycol as the major constituent. The lower boiling methyl alcohol will boil away in a hot radiator and possibly leave the engine unprotected against freezing.

Most commercial antifreeze contains various additives to prevent corrosion, leaks, and damage to rubber parts and foaming. Antifreeze is not developed through the petroleum fractionating process. Although it is an automotive fluid, it will not be included in the discussion of re-refined automotive petroleum-based fluids. Antifreeze can be included in some recycling programs but should not be mixed with engine oil as part of an oil recycling or re-refining process.

Problems

Environmental Impact

Most modern automobiles are liquid-cooled and use a mixture of antifreeze and water as a coolant. Along with additives to inhibit corrosion, antifreeze is usually based on ethylene glycol, although diethylene glycol, propylene glycol, and sodium nitrate may also be used. Antifreeze becomes contaminated over time with traces of fuel, oil, metals (such as copper, lead, and zinc particles), and dirt. It also breaks down to form acids that corrode cooling systems. When mixed with anything other than de-ionized (distilled) water, dissolved minerals in the antifreeze/water mixture form scale deposits that can block lines. Waste antifreeze may contain heavy metals such as lead, cadmium, and chromium in high enough levels to make it a regulated hazardous waste. Never dump a hazardous waste on land or discharge into a sanitary sewer, storm drain, ditch, dry well or septic system. Coolant mixtures are periodically drained and replaced with fresh, uncontaminated coolant.

Question
74

Used antifreeze is potentially dangerous in two ways:

1. Ethylene glycol is poisonous to animals and small children. The bright green color of most antifreeze, coupled with the rather sweet taste of ethylene glycol, makes antifreeze an attractive hazard to those most at danger from drinking it.
2. Antifreeze can become contaminated with a number of hazardous substances while confined within an automobile cooling system. Antifreeze drained from

older automobiles, especially those that have not had cooling system service for a long period, may have a substantial lead content; the lead leaches from the lead-tin solder once used in radiators. If the lead content reaches 5 ppm or if the pH is 12.5 or greater, the antifreeze is considered under federal guidelines to be a hazardous waste.

Worker Safety

Engine coolant is very hot. Take care when checking it or removing it from an engine. Burns can be particularly bad because of the sticky nature of antifreeze. Spill cleanup is emphasized to prevent slipping. Coolant is poisonous; prevention from ingestion is also a concern.

Regulations

The primary law in the State of California is found in Title 22 CCR, Chapter 11, Articles 3, 4, 4.5, and 5 as well as section 66261 and section 5650 and 12016 of the California Fish and Game Code.

Antifreeze will be regulated as hazardous waste if the results from the toxic characteristics leaching procedure (TCLP) indicate metal contents that meet or exceed the following limits:

<u>Metal</u>	<u>mg/L (ppm)</u>
Cadmium	1.0
Chromium	5.0
Lead	5.0

Solutions

Waste Reduction

Avoid spills when servicing. Use in-shop reclaiming machines to remove coolant prior to engine work, radiator, heater core, or thermostat removal and replacement. Use dedicated drain pans and mop buckets to segregate coolant drips and spills from other liquids in the shop.

Recycling

Why recycle antifreeze? It's cost-effective: recycled antifreeze is less expensive than virgin antifreeze. It saves resources. Ethylene glycol is produced from natural gas, a non-renewable resource. Waste antifreeze should be recycled either:

1. In an on-site unit.
2. By a mobile service.
3. Off-site.

Question
75

Many sewage treatment agencies responsible for wastewater treatment discourage or forbid waste antifreeze disposal into sanitary sewers. Waste antifreeze should never be poured down storm drains or into surface waters because it causes serious water quality problems and may harm people, pets, or wildlife. Doing so is illegal and punishable by fines of up to \$25,000.

Recycling antifreeze is feasible in all parts of the country due to the many on-site and off-site recycling options available. Waste antifreeze can be recycled by three methods:

1. On-site recycling: waste antifreeze is recycled in units purchased by the facility, located on-site, and operated by facility employees.
2. Mobile recycling service: a van or truck equipped with a recycling unit visits the facility and recycles waste antifreeze on-site.
3. Off-site recycling: waste antifreeze is transported to a specialized recycling company; these services can also re-supply the facility with recycled antifreeze.

All waste antifreeze-recycling methods involve two steps:

1. Removing contaminants either by filtration, distillation, reverse osmosis, or ion exchange.
2. Restoring critical antifreeze properties with additives. Additives typically contain chemicals that raise and stabilize pH, inhibit rust and corrosion, reduce water scaling, and slow the breakdown of ethylene glycol.

The type of antifreeze recycling that is best suited to your facility depends on many factors. The table in Appendix I summarizes a number of these factors for different antifreeze recycling alternatives.

Can “Organic Acid Technology (OAT) Long-Life Coolants” be recycled? In 1999, about 30 percent of new passenger vehicles and 5 percent of heavy-duty equipment were factory-filled with OAT coolants. Many antifreeze-recycling units such as DexCool™ can recycle OAT coolants.

The most important factor when recycling OAT coolant is to use a technology that completely removes the “chemistry” from the waste coolant. Once the coolant has been recycled, it may be returned to a conventional or OAT coolant depending on the additive package used. Numerous auto repair and fleet maintenance facilities have used recycled antifreeze produced from on-site recycling units and mobile and off-site recycling services for years without experiencing engine damage or other problems as a result.

Regarding consumer protection and manufacturer warranty issues: at this time the American Society for Testing and Materials (ASTM) has no quality standard for recycled antifreeze. However, several State agencies, California Weights and Measures, for example, have issued product specifications for recycled antifreeze. Also, some vehicle manufacturers, (for example, General Motors, Ford Motor Company, Detroit Diesel, and Cummins) test and certify antifreeze recycling equipment or have developed standards for recycled antifreeze.

No single national standard exists for antifreeze recycling methods. You should select an antifreeze recycling method after discussing coolant quality specifications and vehicle warranty concerns directly with your recycling unit or service vendors. Some vendors can provide certification letters from vehicle manufacturers or State agencies, or they will otherwise guarantee the recycled antifreeze they produce.

Waste Management

Used radiator coolant has been determined by the state of California to be a hazardous waste. In addition, radiator coolant has the potential to become contaminated with chlorinated solvents and other contaminants if improperly handled or stored. Radiator coolants are ethylene glycol based and should not be added to used oil for recycling.

You need to protect your waste radiator coolant storage from exposure to rainwater and the resulting runoff into the stormwater drain or sewer system.

Radiator coolant should not be dumped into septic systems, gutters, storm systems, or onto the ground. Used radiator coolant is a hazardous waste and cannot be released into the sanitary sewer or storm drains! A facility must determine that its discharges are non-hazardous as described in 40 CFR 403, subsection 2.7.

Call the local waste treatment facility for answers to your questions concerning storm water runoff or discharging to the sewer.

Antifreeze recycling wastes may be contaminated with metals such as lead, chromium, cadmium, copper, or zinc. Wastes may include filters, sludge, or resins depending on the type of recycling performed. You should obtain data or test the waste to determine whether it is hazardous and dispose of it accordingly. Off-site and some mobile recycling service vendors will dispose of the wastes for you. If your vendor manages your wastes for you, make sure that proper waste determination and disposal are performed.

DO:

1. Use dedicated antifreeze collection equipment, including funnels, transfer pans or buckets, and well-maintained storage containers.

2. Store antifreeze in separate, closed containers marked "WASTE ANTIFREEZE ONLY" and "RECONDITIONED or RECYCLED ANTIFREEZE," as appropriate.
3. Recycle your antifreeze through a recycling service or with on-site equipment. If this is not possible, determine the waste status of all antifreeze before disposal.
4. Keep antifreeze containers closed at all times except when emptying or filling.
5. Store antifreeze containers in a diked area with a sealed surface.
6. Protect antifreeze containers from the elements.
7. Keep accurate records of used antifreeze shipments for three years.

DO NOT:

1. Mix antifreeze with any other wastes, including used oil.
2. Mix radiator flush chemicals with used antifreeze. Dispose of them separately.
3. Pour antifreeze on the ground, into a storm drain, septic tank, or dry well. To do so can contaminate groundwater or surface water or cause problems with the operation of the septic system.

Brake Fluid

The braking system of a vehicle uses hydraulic power generated by a master cylinder to activate the four-wheel brake assemblies. The hydraulic power is transmitted throughout the brake system via brake fluid. Brake fluid is a special liquid formulated from a silicone-based or glycol-based product. Brake fluid is not developed through the petroleum fractionating process. There are three classes of brake fluid commonly used in modern automobiles: DOT 3, DOT 4, and DOT 5. These are Department of Transportation specification grades; the increasing numbers reflect increased boiling point. DOT 3 and DOT 4 are glycol based, with DOT 3 most commonly used in disc brake systems. The glycol base is hygroscopic (meaning it tends to attract water), and as such DOT 3 and 4 brake fluids are most often changed when contaminated with moisture, which could boil and cause erratic brake operation. DOT 5 is a silicone-based fluid that has a higher boiling point and is much less hygroscopic than the glycol-based fluids. Due to their relative expense, DOT 5 fluids are not normally seen in production vehicles, but rather in racing applications that involve heavy braking. More information on brake fluid types can be found in Appendix J.

Problems

Environmental Impact

Brake fluid should not be dumped into septic systems, gutters, and storm systems or onto the ground. It should not be disposed of in the trash. Used brake fluid is a hazardous waste and cannot be released into the environment.

Question
77

Worker Safety

The greatest safety issue with brake fluid is eye damage. Always use safety glasses when working around brake fluid. Gloves are also advised, since dermal absorption does occur. Modern anti-lock brake systems have very high-pressure accumulators that could cause injury if not discharged properly. Consult service manuals for correct procedures.

Regulations

Consult the MSDS for brake fluid to determine its makeup. If an automotive fluid contains toxic additives or contaminants it will have to be managed as a hazardous waste. All used brake fluid must be collected separately, labeled, and disposed of as a hazardous waste.

Solutions

Waste Reduction

Brake fluid is hygroscopic; that is, it absorbs moisture. Do not keep a large stock of brake fluid on hand. Maintain an inventory large enough only to do the work at hand. If brake fluid has absorbed moisture, it must not be used and is therefore wasted. Use the smallest container possible to avoid brake fluid “leftovers.”

Recycling

Brake fluid can be included in some recycling programs but should not be mixed with engine oil as part of an oil recycling or re-refining process.

Waste Management

Determination of used brake fluid as hazardous depends on its initial composition (some brands contain hazardous constituents) and whether it has been contaminated during use or vehicle servicing. Brake fluid can become contaminated with chlorinated solvents if brake cleaner is carelessly sprayed into it during brake repairs. Most brake fluids are glycol-based and they should not be added to used oil. Brake fluid can pose serious health and safety risks if disposed of improperly. As a glycol-based product it cannot be mixed with used oil for disposal. Brake fluid can be recycled.

If your shop services vehicles use silicone-based DOT 5 brake fluid, you may be required by your waste hauler to keep the glycol-based and silicone-based brake fluids separated. The two types of brake fluids are color-coded to aid in identification:

glycol-based DOT 3 and DOT 4 brake fluids are clear to amber, while silicone-based DOT 5 brake fluid is purple.

DO:

1. Collect brake fluid in a separate, marked, closed container and contract with a waste hauler that will recycle it.
2. Determine if your waste hauler recycles brake fluid and if mixing silicone-based brake fluid with glycol-based fluid is acceptable.
3. Have a laboratory test a sample to determine if a fluid is hazardous if you have doubts as to whether or not a batch of brake fluid has been contaminated by solvents.

DO NOT:

1. Spray brake cleaner around open containers of brake fluid.
2. Pour brake fluid down any drain or on the ground.

Gasoline and Diesel Fuel

Problems

Environmental Impact

Fuels are hydrocarbons, and they are damaging to the atmosphere. They are known to aid in the creation of photochemical smog. Fuels, as liquids, are hazardous wastes and cannot be released into the environment.

Worker Safety

Benzene is one of the components of fuel, and this is a known carcinogen. Be sure that workers are not be subjected to breathing the fumes. NEVER siphon fuel. This would result in employees breathing the fumes and could result in ingestion of the liquid. Fuel is flammable and should not be exposed to flames or sparks. Diesel fuel contains bacteria that can cause serious skin infections. Use proper protection to prevent this contact from occurring.

Regulations

The California Air Resources Board (ARB) has set forth many regulations governing the release of gasoline vapors from vehicles. Emission systems must be in proper working order. Fuel delivery systems are regulated, preventing the escape of vapors into the atmosphere.

Solutions

Waste Reduction

Fuel has a “shelf life.” When a vehicle is not going to be operated for longer than six months, fuel should be properly removed from the tank to prevent the fuel from becoming a hazardous waste. Small engines such as chain saws and lawn mowers are particularly susceptible to this problem.

Recycling

Fuel cannot be recycled. It is a hazardous waste, and it must be treated accordingly if disposed.

Waste Management

Bad or old fuel is a hazardous waste. It must be stored, labeled, handled, and treated as such.

Question
80

In-Shop Usage

Not all liquid wastes come from vehicles; many are found in the shop. Some are used in the cleaning of vehicle components. These can be aerosol spray solvents, solvent sinks, and chemical baths, both acidic and alkaline in nature. Wastewater generated by shop cleanup is another big concern.

Cleaning Liquids

Cleaning solutions, solvents, and degreasers come in three forms:

1. Petroleum based mixtures of mineral spirits, Stoddard solvent, petroleum naphtha, and xylene. Mineral spirits are a solvent commonly used for part cleaning because of its ability to quickly dissolve oil, grease, dirt, grime, burnt-on carbon, and heavy lubricants.
2. Halogenated solvents found in degreasers and carburetor cleaners.
3. Aqueous (water-based) detergent cleaners.

Question
81

These cleaning liquids are generally applied in four ways:

1. Soak tanks—degreasers and carburetor cleaners.
2. Sinks—mineral spirits, solvents, and aqueous.
3. Spray cabinets.
4. Spray cans—aerosol and refillable.

Parts Washers—Mineral Spirits

Parts washers using mineral spirits and other hydrocarbon solvents are the oldest and most common means of degreasing parts. Most mineral spirits-based parts washers continually re-circulate the solvent through a filter to extend the time between solvent change-outs. Most of the petroleum solvents used in these washers are considered hazardous wastes due to their low flash point and resulting ease of ignition. The variety of metal particles, dissolved lubricants, and other debris suspended in the dirty solvent further contribute to the hazardous nature of the solvent. The tendency of shop personnel to use aerosol cans of brake cleaner and other chlorinated solvents over the open parts washer also adds to the hazardous nature of used parts washer solvent.

Question
82

Solvents, principally from parts washers, are typically the largest source of hazardous waste generated by vehicle repair shops. Solvent use and waste can be lessened by reducing solvent cleaning requirements (if possible); extending solvent life, and recycling used solvent on-site. Recycling can be done via lease/purchase of a parts washer that filters and recycles the solvent. If 750 gallons or more per year of solvents are being disposed as a hazardous waste, buying or leasing such a unit may make good business sense.

The need to have mineral spirits-based parts washers periodically serviced by a licensed vendor is in a substantial expense for many auto repair shops. Mineral spirits-based parts washers can use many of the newer, alternative solvents that are not hazardous if used alone. Switching to one of these might reduce the overall expense of parts washing. Depending upon the volume of parts washing, it might be economically feasible to purchase or lease a spray cabinet-type parts washer that uses an aqueous detergent solution instead of solvents.

Parts Washers—Aqueous

Aqueous (water-based) parts washers have proven to be a cost-effective and environmentally friendly alternative to cleaning parts for most medium- to large-sized vehicle repair facilities. Any shop using several solvent-based parts washers should investigate switching to an aqueous parts washer with a recyclable wastewater system. A recyclable system minimizes or eliminates potential wastewater disposal problems. Shop workers need to take precautions when working with aqueous parts washer operations, despite their environmental benefits. Remember that sludge by-products that collect at the bottom of an aqueous parts washer can be a hazardous waste due to the presence of metal particles and/or certain solvents.

Question
83

DO:

1. Determine by testing whether your wastewater and/or sludge are hazardous, then dispose of these wastes appropriately. Keep all testing records for three years.
2. Check with your local sewer utility before discharging any wastewater into the sanitary sewer system.

3. Check with your sewer utility or city engineering department to verify that your drains go to a sanitary sewer. Most outside drains and some inside drains do not go to a sewage treatment plant; these are storm drains leading directly to a stream, lake, ditch, or dry well. Discharging wastewater into any of these may contaminate surface water or groundwater. Permits may be required for this type of discharge.
4. Consider switching to an aqueous system if you now use mineral spirits-based parts washers.
5. Consider parts washers that use an aqueous cleaner with filter and microbes that digest oils and grease, eliminating wastewater disposal.
6. Consider using dry steam to clean parts.
7. Close off all drains that lead to storm sewers, dry wells, or septic systems.

DO NOT:

1. Dispose of parts washer wastewater down any storm drain, into a septic system, dry well, or on the ground.
2. Dispose of hazardous parts washer sludge on the ground or in the trash dumpster.
3. Use aerosol spray cans near your parts washer.

Brake and Carburetor Aerosol Spray Cleaners

Brake and carburetor cleaners traditionally have consisted of chlorinated hydrocarbons, such as methylene chloride, dispensed from aerosol spray cans. There has recently been a move toward the use of alternative solvents, primarily in reaction to the numerous health hazards posed by chlorinated hydrocarbons and increasing government regulation of such solvents.

Chlorinated solvents are also a problem in the auto repair shop environment due to the risk of contaminating other waste fluids (antifreeze, motor oil, etc.) with over spray or runoff. Careless use of chlorinated solvents can easily lead to contamination of other fluids that would otherwise be considered non-hazardous. An aerosol can that will not function properly but is still full may be a hazardous waste.

Keeping Aerosol Products Away from Aqueous Brake Washers

If you use aerosol brake cleaners to spot clean or dry brakes after aqueous brake washing, be aware that many aerosol products contain F-listed chemicals. An F-listed chemical is a chemical that makes each waste it contaminates a hazardous waste, no matter what its concentration in the waste is.

Even one drop of an F-listed aerosol solvent that drips into your brake washing solution is enough to make it a regulated hazardous waste! If you must use aerosol products to spot clean, always move the aqueous brake-washing unit away from the

brake area first. To save time and avoid potential regulatory problems, use compressed air to dry brakes rather than aerosol brake cleaner.

N-Hexane Use as a Brake Cleaner

Question
84

Hexane is a solvent used mainly in vegetable oil extraction and in cleaners, degreasers, glues, and spray paints. N-Hexane is one kind of Hexane. Commercial Hexane usually contains 200/0 to 800/0 n-Hexane, so you should treat all Hexane as n-Hexane. Pure n-Hexane is a colorless, fast-evaporating liquid with a faint disagreeable odor.

Problems

Environmental Impact

Mineral spirits contain volatile organic compounds (VOC) that contribute to smog formation and may be toxic when inhaled. Solvents can also contain chlorinated hydrocarbons depending upon use. Mineral spirits raise significant environmental and human health concerns, although they are effective for cleaning.

Worker Safety

Using solvents creates unnecessary liabilities for the shop relating to the environment, worker health, and fire. Mineral spirits evaporate quickly, making worker exposure difficult to control.

The substances and the contaminants acquired during the use of solvents make spent solvents hazardous wastes, because they are ignitable and/or toxic.

Solvents are highly volatile and flammable. Review the product safety data sheet prior to its use to determine the hazards it poses. Wear appropriate skin and eye protection. Work in a ventilated area and/or use proper respiratory protection. Check the MSDS to determine the appropriate respirator for a specific solvent. Most solvents contain volatile organic compounds; make sure that solvent containers are tightly covered so vapors are not released.

N-Hexane

Question
85

Long-term overexposure to n-Hexane can damage the nerves in the feet, legs, hands, and arms. The damage can be long-lasting and might become permanent. Symptoms include numbness, tingling, weakness (sometimes even paralysis), and reduced ability to feel touch, pain, vibration, and temperature. Short-term overexposure can cause headache, dizziness, loss of appetite, giddiness, and drowsiness. Health effects have been reported only when exposure levels were above California's Workplace Permissible Exposure Limit. But people working with n-Hexane can easily be exposed to levels that high. Reported cases of nerve damage, identified among auto mechanics using spray brake cleaner that contains n-Hexane, prompted a health hazard advisory. See Appendix K for more information on n-Hexane.

How to Know if You Are Working With n-Hexane

If you risk exposure to n-Hexane at work, ask to see the MSDS for each brake and parts cleaning product in your work area. Your employer must have an MSDS for any workplace product that contains a hazardous substance and must provide it to you on request. If a product contains n-Hexane, the MSDS should identify it in section 2 by the CAS number 110-54-3.

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Do You Use Any of These Products?

- ☐ Amrep Brake Parts Cleaner.
- ☐ Berryman B-12 Chemtool Carb and Choke Cleaner.
- ☐ Berryman Chemtool Air-Intake Cleaner.
- ☐ Berryman Non-Chlorinated Brake Cleaner.
- ☐ Certified Labs Dylek PS Aerosol.
- ☐ Continental Research Brake Master.
- ☐ Drummond American Corp. Strafe.
- ☐ Loctite Disc Brake Quiet.
- ☐ Loctite Flam Brake Clean.
- ☐ Loctite ODC-Free Cleaner and Degreaser.
- ☐ Loctite Pro Strength Degreaser.
- ☐ Malco Brake and Parts Wash.
- ☐ Malco Carb, Choke and Injection Cleaner.
- ☐ Mantek DJC PS Aerosol.
- ☐ Penray Non-Chlorinated Brake Gard.
- ☐ Seymour of Sycamore Non-Chlorinated Brake Cleaner.
- ☐ Sherwin Williams Automotive Cleaners.
- ☐ Sherwin Williams Brake Parts Wash.
- ☐ Sherwin Williams Cleaner/Degreaser.
- ☐ Sherwin Williams Non-Chlorinated Brake Cleaner.

- ❑ Sherwin Williams Parts Wash.
- ❑ Taylor Made Non-Chlorinated Brake Cleaner.
- ❑ Technical Chemical Non-Chlorinated Brake Cleaner.
- ❑ Winzer Brake Cleaner, Non-Chlorinated.
- ❑ Wurth Brake and Parts Cleaner (liquid and aerosol).
- ❑ Zep Aerosol Brake Parts Cleaner.
- ❑ Zep Brake Wash (liquid).
- ❑ Zep Parts Cleaner (aerosol).

(In a recent survey, these products were reported to contain n-Hexane. However, the ingredients in products like these are changed quite often, so be sure to check the safety data sheets for the products you're using.)

How n-Hexane Enters Your Body

Question
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N-Hexane enters your body when you breathe its vapors or droplets of spray in the air. N-Hexane can enter your body when it touches your skin. The degree of adverse health effects depends on the amount of n-Hexane that enters your body. Major concerns are the amount (concentration) of n-Hexane in the air and the time you are exposed.

Effects on the Nervous System

Repeated overexposure to n-Hexane (that is, for months at a time) can result in damaged nerves in the feet, legs, hands, and arms. This damage is called peripheral neuropathy. The first symptom is usually numbness or tingling in the feet and legs, and then in the hands. There may be reduced ability to sense touch, pain, vibration, and temperature. Muscles may become weak, especially in the hands, legs, and feet. In severe cases, there may be muscle wasting (shrinking) and, rarely, paralysis. These effects often improve slowly if exposure is stopped, but they can last for many months and may be permanent. The symptoms might even continue to get worse for a few months after exposure ends.

Short-term overexposure can temporarily affect the brain, causing headache, dizziness, loss of appetite, giddiness, and drowsiness. These effects disappear within hours of the end of exposure.

Nerve damage has occurred among workers exposed to air concentrations of n-Hexane that are only minimally above the workplace Permissible Exposure Limit (50 ppm-see below). Workers can easily be exposed to levels well above 50 ppm if

exposure is not controlled. Exposures causing short-term effects on the brain are also high enough to cause peripheral neuropathy if the exposure happens frequently.

N-Hexane is more likely to damage nerves if used with acetone, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), or lead acetate. Don't use n-Hexane in combination with these chemicals.

N-Hexane breaks down in the body to form methyl n-butyl ketone (MnBK) and 2,5-Hexanedione (2,5-HD). Those are the chemicals that actually damage the nerves. Some products may contain MnBK or 2,5-HD. Do not use those products.

Other Effects

n-Hexane is not likely to cause health problems other than those described above. Exposure to very high levels (20 or more times the legal exposure limit) was found to damage the sperm-forming cells and the lungs of test animals. However, these effects have never been reported in humans. Hexane does not appear to be a special hazard to pregnancy. N-Hexane does not cause genetic mutations. We do not know whether n-Hexane causes cancer; when it was tested in animals, the results were unclear.

Are There Any Tests for Health Effects and Exposure?

A neurologist or a doctor who specializes in occupational medicine can determine if your nerves are damaged. The simplest way is to test nerve conduction velocity (how fast a nerve carries a message). Nerve damage from n-Hexane exposure usually occurs on both the left and the right sides of the body equally. Symptoms on just one side are likely to have a different cause, such as diabetes, carpal tunnel syndrome, medications, or alcohol use.

A urine test for the toxic breakdown product, 2,5-hex-anedione, can be used to estimate exposure within the previous week. The best time for a urine sample is at the end of the last shift of a work week. n-Hexane and its breakdown products are not stored in the body for long. They are eliminated fairly quickly through the breath and urine, however the amount in your body can increase over a work week if you're exposed every day.

Workers who will be regularly exposed to hazardous substances should be given a complete physical examination at the beginning of their employment. The exam should include medical and work histories. They should also have periodic follow-up examinations.

How to Control Your Exposure

Your employer must protect you from being exposed to chemicals at levels above the legal exposure limits. Cal/OSHA and the Cal/OSHA Consultation Service can help you and your employer.

Regulations

Spent mineral spirits are hazardous wastes, and the shop owners are responsible for proper disposal of all hazardous wastes. Some areas of the country have restricted use of solvents in parts cleaning operations.

Always check the product's material safety data sheet to determine safe shop practices and proper disposal method. Waste solutions produced from parts washing are subject to RCRA reporting, waste minimization, and disposal requirements. Parts cleaner solutions are usually contaminated with metals, oils, and dirt picked up during the cleaning process. Most solvent-based wastes are considered hazardous because they are flammable and/or toxic. Characterized solvent wastes are judged toxic either because of their original chemical composition or because they have been contaminated with heavy metals in use. Many petroleum distillates, mineral spirits, and naphtha have flash points less than 140° F. These wastes are ignition hazards.

Spent solvent waste is considered hazardous due to its ignitability, toxicity characteristics, or because it contains listed chemicals. No substance classified as a hazardous waste can be released into the sanitary sewer or storm drains! A facility must determine that its discharges are non-hazardous as described in 40 CFR 403 subsection 2.7. Spent solvents should never be placed in a trash dumpster. Spent parts cleaner solutions must be controlled in the shop to prevent them from contaminating any stormwater drain or sewer system. Call your local sewer system for answers to your questions concerning stormwater runoff or discharging to the sewer.

Permissible Exposure Limits

The Cal/OSHA Standards Board sets Permissible Exposure Limits (PEL) for the amounts of certain chemicals in workplace air. The PELs are intended to protect the health of most people who are exposed every day over a working lifetime.

Cal/OSHA's PEL for n-Hexane is 50 parts of n-Hexane per million parts of air (50 parts per million, or 50 ppm). You may also see this stated as 180 milligrams of Hexane per cubic meter of air (180 mg/m³). Legally, your exposure may be above the PEL at times, but only if it is below the PEL at other times. Your average exposure for any eight-hour work shift should be no more than 50 ppm.

Monitoring

If you work with n-Hexane and think you might be overexposed, talk to your supervisor or your union. If any worker might be exposed to a substance at more than the legal limit, the employer must measure the amount of the substance in the air in the work area (Title 8, Section 5155[e]). You have the legal right to see and copy the monitoring results (Title 8, section 3204).

You cannot rely on your sense of smell to warn you of overexposure to n-Hexane. N-Hexane has only a very faint smell, and it's not very irritating to the eyes, nose, or

throat. You can easily be overexposed without knowing it. The only reliable way to know the exposure level is to measure the amount in the air.

Hazard Communication Standard

Under California's Hazard Communication Standard (California Administrative Code, Title 8, section 5194), your employer must tell you if you are working with any hazardous substances and train you to use them safely. They must make material safety data sheets available.

Injury and Illness Prevention Program

Every employer must have an effective, written injury and illness prevention program (IIPP) that identifies the person with the authority and responsibility to run the program (Title 8, section 3203). The IIPP must include methods for identifying workplace hazards, methods for correcting hazards quickly, and it must conduct health and safety training at specified times. The IIPP must include a system for communicating clearly with all employees about health and safety matters (including safe ways for employees to tell the employer about hazards) and recordkeeping to document the steps taken to comply with the IIPP.

Access to Medical and Exposure Records

You have the right to see and copy your own medical records, and any records of your exposure to toxic substances. These records are important in determining if your health has been affected by your work. Employers who have such records must keep them current and make them available to you for at least 30 years after the end of your employment.

Solutions

Waste Reduction

Keep soak tank containers closed when not in use to avoid evaporation. Solvent should never be used for the general cleaning of shop floors. When not in use, all solvent cleaning tanks must be covered and/or drain plugs closed. Solvent losses due to inappropriate usage, equipment leaks or spills, and evaporation can range from 25 to 40 percent of total solvent usage. Use cans of spray cleaner only when parts cannot be removed from the car and cleaned in a solvent sink.

Use a solvent sink with a recirculating base tank to reduce your solvent losses. Place your solvent sinks close to where cleaning will be done. Remove parts slowly after immersion to reduce drippage. Install drip trays or racks to drain cleaned parts, allowing more drainage time over the sink after withdrawal. Turn off the solvent stream, covering or plugging sink when not in use. Many solvent service companies will lease you a sink and, for a small fee, they will pick up dirty solvent, clean and maintain the solvent sink, and refill the sink with clean recycled solvent. The cost for contracting with a service provider is often less than the combined cost of solvent purchase, sink maintenance, and waste disposal.

- ❑ Consider using less hazardous solvents or switching to a spray cabinet parts washer that does not use solvent.
- ❑ Install a filter on your solvent sink to greatly increase the life of the solvent.
- ❑ Consider purchasing your own solvent still and recycling solvent on-site.
- ❑ Be aware that sludges, filters, and still bottoms (solvent distillation residues) generated from on-site solvent recovery systems are hazardous.
- ❑ Keep spent solvent wastes in separate, labeled, closed containers.
- ❑ Don't mix solvents with any other wastes, especially used oil!

Many shops have completely abandoned the use of brake cleaners and carburetor cleaners packaged in aerosol cans in favor of non-hazardous solvents dispensed from reusable spray cans. The new solvents are purchased in bulk and used to refill the reusable spray can. The can is then pressurized with compressed air from the shop system, via a fitting on the top of the can. Not only are the new solvents more environmentally friendly, they are in many cases more effective cleaners than the solvents they replace. In addition, the compressed air-driven spray cans deliver a more concentrated stream of cleaner to the part in comparison to aerosol spray cans.

Aqueous Brake Cleaning

This subject requires additional coverage because of the special requirements for cleaning automotive brakes. Asbestos and other particles cause worker safety issues as well as environmental impact. Aerosol spray cans have become the standard, and with them come very serious problems. These will be covered in more detail in the following section. The best alternatives for avoiding these problems are aqueous brake washers. Aqueous brake washers perform as effectively as traditional solvent washers, they are better for the environment, and they reduce hazardous waste management costs and liability.

Washing brakes before inspection and repair helps create a clean work area. It also removes dust and debris that prevent the brakes from functioning properly and cause squeaking and grinding. Brake washing can be performed using three devices:

1. Aerosol cans of solvent-based brake cleaner.
2. Solvent brake-washing units.
3. Aqueous brake-washing units.

The best environmental practice is to use aqueous brake-washing units. Aqueous brake-washing units use water-based cleaning solutions. These solutions are nonflammable and generally less toxic than petroleum-based solvents. Furthermore, aqueous cleaners contain little or no volatile organic compounds (VOC) that can harm the environment and shop employees. Aqueous brake washing units are widely available and perform as well as solvent-based equipment. Aqueous brake washers have the following advantages:

- ❑ Little or no solvent vapors or aerosol mists that can be harmful to your workers' health.
- ❑ Nonflammable.
- ❑ Do not contribute to smog formation, climate change, or ozone depletion.
- ❑ No empty aerosol cans discarded as bulky, non-biodegradable trash.
- ❑ Reduces overall environmental and safety liabilities for the shop.
- ❑ Can save you hundreds of dollars per year after payback period.

Most aqueous brake-washing units function much like sink-top parts cleaners. Aqueous brake washers feature a portable basin that can be adjusted to fit under the wheel assembly. Most technicians prefer units with adjustable sink height. Compressed air pumps the aqueous solution through a hose and a flow-through brush. A filter is often used to collect debris and keep the solution clean. Aqueous units range in cost from \$500 to \$1,200 to purchase, or \$45 to \$85 per month to lease (lease cost includes waste management).

Brake and Carburetor Cleaners

DO:

1. Remove excessive oil, dirt, and grease from parts with a wire brush or rag prior to using cleaners. This will reduce the amount of cleaner needed.
2. Consider replacing brake cleaners and carburetor cleaners that contain chlorinated solvents with other less- or non-hazardous cleaners.
3. Consider using reusable spray cans instead of throwaway aerosol spray cans.
4. Collect chlorinated brake cleaner or carburetor cleaner residue separately from other wastes to avoid cross-contamination and an increase in the amount of hazardous waste generated per month.

5. Keep brake and carburetor cleaner containers closed when not in use to avoid evaporation, spills, and the possibility of fire or explosion.
6. Manage your used chlorinated brake cleaners, carburetor cleaners, and cleanup residue as hazardous wastes. Keep in mind that partially empty, unusable (due to a missing or clogged spray valve, etc.). aerosol cans of chlorinated solvents should be treated as hazardous wastes.

DO NOT:

1. Dispose of brake or carburetor cleaner down any storm drain or into a septic system, dry well, sewer, dumpster, or on the ground.
2. Use chlorinated brake or carburetor cleaners around other solvents. Do not mix them with any other solvents (for example, parts washer fluid) by spraying them over the open parts washer or over open pans used to collect antifreeze or used oil.

Ventilation

Make sure that there is good ventilation in the shop. "Local exhaust ventilation" is most effective. It captures contaminated air at the source, before the Hexane can spread into your breathing zone. Next best is general ventilation, which uses a fan-powered system to bring fresh air into the work area. Open doors and windows usually provide very little ventilation. An indoor fan that blows contaminated air around without removing it from your work area is not effective.

Respiratory Protection

N-Hexane has very poor "warning properties" (it has little odor and isn't very irritating). Only supplied-air respirators are approved for protection against n-Hexane. Filter respirators are not approved, because when the cartridge "wears out" there is no warning to alert you that the respirator no longer provides protection.

Skin Protection

It may be hard to avoid getting parts cleaning products on your hands. If you use a water-based cleaner and make sure that it's pH neutral (to prevent irritation and burns), you probably won't need protective gloves. If you must use n-Hexane products and you will likely have frequent skin contact, wear protective gloves and replace them often. Viton and polyvinyl alcohol are recommended, and Silvershield and chlorinated polyethylene are also good. Other glove materials, such as latex rubber, provide very poor protection against n-Hexane. California law requires an employer to supply gloves or any other necessary safety equipment at no cost to the employee.

Substitution

The surest way to protect yourself is to switch to products that don't contain n-Hexane. Avoid using products for which you do not have an MSDS. Especially avoid using products that combine n-Hexane with acetone, MEK, MIBK, or lead acetate.

Switch to water-based (aqueous) cleaners for cleaning of brakes and other vehicle parts. Some aqueous cleaners work as well as solvent cleaners, and they don't pollute the air in the workplace or the environment. Unlike solvent cleaners, aqueous cleaners are usually nonflammable. An aqueous cleaning system will probably even save the shop money, because using an automated aqueous spray cabinet to clean parts can greatly reduce labor time. Aqueous cleaners also last longer, so you won't need to buy as much of them. Environmental compliance may also be easier, and you can reduce your hazardous waste disposal costs. Experience shows that switching to an aqueous cleaning system can pay for itself within as little as three months to a year. Many vendors offer their aqueous systems free of charge for a testing period of a week to a month to help you select the best system for your shop. If you can't switch to n-Hexane-free products, take other steps to limit your exposure.

Use Less

If you must use Hexane products, use as little as possible. Keep containers closed between uses. Hexane can evaporate quickly from a Hexane soaked rag, so make sure that used rags are kept in a well-ventilated area.

Recycling

Spent soak tank solutions should be recycled or properly disposed of at a permitted hazardous waste disposal facility. Many shops have cut down on the amount and toxicity of solvents they are using by turning to less toxic alternatives.

There are a number of companies who provide on-site recycling equipment designed for the filtration or distillation of parts washing solutions. Consider changing to water-based and/or biodegradable cleaners as substitutes for petroleum-based solvents. Check with your local trade association or your local or State regulatory agencies for information and phone numbers.

Waste Management

More efficient parts-washing procedures can help eliminate waste. Monitor the effectiveness of the parts washing solvent and do not change out the solvent until it no longer will clean parts to the level expected. Extend the life of your cleaning solution by using "dirty" solvent for pre-cleaning of dirty parts, before they are put into the main parts washer. Minimize the number of parts-washing stations in your shop. Make sure your parts washers are turned off and if they have lids, keep them closed when not in use.

Water-based parts cleaning solutions can also be dangerous because of their caustic properties. Carburetor cleaners are corrosive liquids that contain chlorinated compounds. Carburetor cleaner should be segregated from other wastes. Waste carburetor cleaner should be accumulated separately in a suitable container or system for proper waste management. Consider eliminating a chlorinated carburetor cleaner and switching to a less hazardous, non-chlorinated cleaner.

Hazardous solvents should always be used only when no other suitable cleaner is available for the job. The major ways to avoid or reduce the generation of solvent waste include eliminating the need to use solvent; finding adequate substitutes for solvents; minimizing losses associated with solvent use; and segregating, recycling, recovering, and reusing waste solvents.

Terpene-based cleaners are increasingly being used in place of Stoddard solvent. The terpene cleaners are available commercially as water solutions with surfactants, emulsifiers, rust inhibitors, and other additives. Terpenes have tested favorably as substitutes for halogenated solvents in removal of heavy greases and oily deposits.

Efficient approaches for minimizing or eliminating the use of hazardous solvents are pre-cleaning parts with a wire brush followed by steam cleaning, a high-pressure wash, or a hot bath that recycles an aqueous solution.

Use halogenated solvents judiciously! Solvent should never be used for the general cleaning of shop floors, and it should only be used in a well-maintained self-contained cleaning system. When not in use, all solvent cleaning tanks must be covered and/or the drain plugs closed. Solvent can be wasted through equipment leaks, spills, poor application techniques, and evaporation.

The cost for collection and/or the disposal of parts cleaning solutions can be determined by making contact with service providers who reclaim, recondition, and recycle solvents.

Parts cleaning solutions are considered a hazardous material. You may be subject to a county waste generator fee, and you may need to update your business emergency response plan and hazardous communications plan. Check with your local CUPA for more information.

The recycling and disposal of parts cleaning solutions require record keeping and reporting. Generators that ship spent solvents for off-site treatment and disposal are required to fill out a hazardous waste manifest. Check with your local governing agency if you have questions.

Minimize the costs and liabilities by switching to aqueous cleaners. Aqueous cleaners are water-based solutions that, unlike petroleum-based solvents, are typically nonflammable and contain little or no VOCs. Instead of dissolving grease and solids with VOCs, aqueous cleaners rely on heat, agitation, and soap action to break dirt into smaller particles.

Although they clean differently, aqueous cleaners perform as well as solvents. On the fact sheet, aqueous cleaners are defined as water-based cleaners that contain less than 5 percent (50 grams per liter) of VOCs. Hundreds of aqueous cleaner formulations are available commercially. The California South Coast Air Quality

Management District maintains a list of aqueous solutions that are certified to contain less than 5 percent VOCs. This list is available at www.aqmd.gov/tao/cas/prolist.html.

The equipment used is critical to successful aqueous cleaning because it applies two important mechanisms to the cleaning process: mechanical force and heat. Two types of aqueous cleaning units that are applicable to most auto repair shops are sink-top and spray cabinets. Most shops will likely meet all their cleaning needs by implementing both types of units. Specialty shops that clean many transmissions and carburetors may also want to investigate using ultrasonic and immersion type units.

Managing Aqueous Cleaning Wastes

The wastes generated from aqueous cleaning should be managed as described in the following section.

Waste Solution

Aqueous cleaning solutions may qualify as hazardous waste after extended use because concentrations of metals such as cadmium, copper, lead, and zinc may exceed State or federal limits. Therefore, auto repair shops should always use a licensed waste disposal company to manage waste solution.

Many waste disposal companies will analyze the waste solution for you to determine whether it is hazardous. The cost of disposal varies according to the characteristics of the waste and the volume generated, but will generally be \$2 to \$4 per gallon if it is a hazardous waste, and \$1 to \$2 for non-hazardous waste. Do not dump waste solution in the sewer or septic system unless you obtain permission from your local sewage treatment agency.

Aqueous brake washing solutions contain proprietary compounds when purchased that are either non-hazardous or considerably less hazardous than solvents. With proper filtration and regular addition of fresh solution to make up for evaporative losses, many shops can go for years without requiring solution disposal. Over time, contaminants build up creating sludge and making the solution less effective.

Waste solution, sludge, and filters may contain metals that have washed off the brake assembly, or solvents that dripped into the sink and contaminated the solution. Waste solution, sludge, and filters should be shipped off-site as either hazardous or non-hazardous wastes. Obtain data or test the waste stream at least once to make this determination, and dispose of the waste solution and filters accordingly. Some unit vendors will dispose of the spent solution for you and include the cost of this service in the unit's rental price. An informal survey of San Francisco Bay Area shops revealed that aqueous solution is changed about once every three years, on average.

Used Filters from Aqueous Cleaning Machines

Used filters may be recycled along with spent engine oil filters with the permission of the recycler. Contact your oil recycler to determine if they will take your filters. Some recyclers will only accept used filters if they are encased in metal shells like engine oil

filters, and some states prohibit recycling aqueous filters with engine oil filters. If they are not recycled with engine oil filters, used filters should be managed as hazardous waste and disposed by a licensed waste disposal company. Contact your state environmental agency to learn if any special rules apply to used filters.

Skimmed Oil

Oil skimmed from an aqueous cleaning solution can be managed as used oil and recycled. Most recyclers will accept skimmed oil with used motor oil as long as it is not contaminated with solvent.

Simple Sludge Management

Little or no sludge accumulates in aqueous cleaning units with filtration, but sludge may accumulate at the bottom of units without filtration. This sludge may be disposed of along with waste solution. Most waste disposal companies will accept a certain percentage of solids in the waste solution. If the sludge is separated from the solution, the sludge may not be disposed as solid waste unless tested to determine it is non-hazardous.

Acids

Acids are not generally found in the automotive shop except in batteries and metal finishing of crankshaft surfaces. They may be found in some cleaning processes.

Problems

Environmental Impact

Acids are very damaging to the environment. They make their way as liquids into water supplies, with repercussions to plants and animals. Sewage and water pipes and building foundations are also corroded and destroyed by sulphuric acids.

Worker Safety

Acid can cause severe burns to the skin and eyes. Always use safety goggles and gloves if acid must be handled. The presence of other substances within an acidic mixture solution may cause the solution to be carcinogenic and very toxic.

Regulations

These solutions must be handled as hazardous waste according to local, State, and federal regulations.

Solutions

Waste Reduction

Most automotive batteries are “maintenance free” and are filled with electrolyte at the place of manufacture. This has eliminated the need for acid to be stored on-site. If you use only these types of batteries, the storage of sulphuric acid is no longer an issue.

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Recycling

Return all batteries to the local battery supplier.

Waste Management

Acids are usually very concentrated and require very large amounts of water to dilute. Neutralize acids with a base to manage their effects. Note: This neutralization process presents the problem of disposing of the final mixture. The best way to manage acids is to dispose them according to local, State, and federal regulations.

Alkaline Solutions

Some shops use hot tanks for cleaning greasy parts. These tanks contain a caustic (alkaline) solution with a pH greater than 7, which is heated to increase its efficiency in loosening the grip of oil and grease on surfaces. Hot tanks are very effective in cleaning oily or greasy parts, do not rely upon solvents, and do not require frequent service. However, when the hot tank solution is changed, the used solution and sludge from the tanks typically become hazardous wastes because of their corrosivity and heavy metal content.

Question
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Problems

Environmental Impact

Alkaline solutions are very damaging to the environment. They make their way, as liquids, into water supplies with repercussions to plants and animals.

Worker Safety

Alkaline solutions can cause severe burns to the skin and eyes. Always use safety goggles and gloves if acid must be handled. The presence of other substances within an alkaline mixture solution may cause the solution to be carcinogenic and very toxic.

Question
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Regulations

These solutions must be handled as hazardous waste according to local, State, and federal regulations.

Solutions

Waste Reduction

If your shop makes relatively heavy use of a hot tank, you might consider one of the alternative parts cleaner technologies that are now available for medium- and large-volume applications. Cleaning systems that use water-based (aqueous) cleaning solutions are available, as are systems that use steam. Both types generate considerably less waste liquid than a hot tank.

Recycling

No specific information available. Treat alkaline solutions as hazardous waste.

Waste Management

DO:

1. Accumulate all sludge and used solvents from hot tanks in a closed, marked container.
2. Determine by testing if sludge and used solvents are hazardous and manage accordingly.
3. Consider alternative cleaning methods such as detergent-based (aqueous) parts washers.

DO NOT:

1. Dispose of used hot tank solution down any drain or on the ground.
2. Dispose of hot tank sludge on the ground.

Wastewater

Engine and Vehicle Cleaning Wash Water

Question
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Many shops wash engine compartments or entire vehicles as part of their business. The runoff and detergents from engine compartment washing often contains oil and grease that threatens aquatic life and drinking water supplies. In outside washing without the proper containment and sewer hookup, the wash water eventually reaches a storm drain or septic drain field. Water from engine and vehicle washing is process wastewater, and it should never be allowed to flow into storm drains or septic drain fields.

Floor Cleaning Wash Water

The runoff from shop floor washing often contains metals, oil, and grease that threatens aquatic life and drinking water supplies. For this reason, many local governments require that wash water be routed to a sanitary sewer for treatment in the local waterworks, rather than allowing it to run into storm sewers which ultimately drain into creeks, streams, and lakes.

In addition, many local governments require that shop floor drains be routed to a passive oil/water separator before being discharged to the sanitary sewer. The sludge that gathers at the bottom of such separators may be a hazardous waste; testing is required to establish the nature of the sludge. Some shops reduce the amount of sludge that collects by utilizing an active oil/water separation system to skim oily wastes. The concentrated oily waste is retained by the system and collected periodically for recycling.

Question
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Why Be Concerned About Oil/Water Separators (OWS)?

Oil/water separators (OWS) can be costly to maintain. If not properly managed, they can pollute surface water and groundwater and lead to costly violations. Have you taken steps to minimize the effects of your oil/water separator on your budget and the environment?

Sump Sludge

The sludge that gathers in your sump or oil/water separator can be a hazardous waste. Have the sludge tested by a laboratory to determine if it is hazardous.

Problems

Environmental Impact

Wastewater ends up in one of three places:

1. *Storm Drains.* Water flows untreated from storm drains directly to creeks, streams, lakes, bays, and oceans. If this water is contaminated, it can harm aquatic life; even soapy water can upset aquatic ecosystems.
2. *Septic Systems.* Discharges to septic systems can cause soil, groundwater and drinking water contamination, creating site cleanup liabilities.
3. *Sanitary Sewers.* Metals accumulate in sewage treatment sludge, preventing its beneficial use. Some contaminants “pass through” and are discharged to lakes, rivers, bays, and oceans.

Question
94

Worker Safety

There is little concern to workers doing the cleanup unless the material being cleaned up has toxic properties. OSHA requires clearly marking wet areas due to the risk of slipping created by wet floors.

Regulations

The Clean Water Act makes it illegal to discharge pollutants to surface waters; violators can face imprisonment and fines of up to \$25,000 per day! Storm drain connections to indoor drains or sinks are prohibited in most areas. Storm drains are usually located outside a shop. If you are unsure about the nature of your shop drains, ask the building manager or local sewer authority if any of the drains are connected to stormwater sewers.

Solutions

Waste Reduction

Question
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Keep a dry shop. The history of wastewater regulations is clear: discharge limits will continue to become more stringent. Minimize the impact of these regulations on your shop by adopting a dry shop goal. A dry shop is a shop that has sealed all of its floor drains. A 100 percent “dry shop” may not be feasible in your area due to melting snow and ice, but the methods and equipment presented in this section will help you reduce floor wash water volume and contamination. This, in turn, reduces your liabilities, protects the environment and community, and even saves you time and money spent cleaning floors.

The least expensive approach to dealing with floor wash water is to avoid producing it if at all possible. Leak prevention practices such as using drip pans to prevent fluid leaks from reaching the floor and using funnels to avoid spillage can help minimize the need to wash down oily spots. Dry cleaning methods such as using a push broom and dustpan to pick up debris and dust also help avoid the need to wash the shop floor.

Making Sure Your Oil/Water Separator Works Properly

- ❑ Eliminate contaminants: Don't rely on the oil/water separators to handle wash water from fuel, coolant, solvent, oil, or paint spills. Instead, clean up spills when and where they occur with dry methods mentioned in this section.
- ❑ Wash without detergents: Emulsifying cleaning compounds disperse oil in wash water and make OWSs ineffective—oil passes right through to the sewer. High-pressure water or non-emulsifying cleaners are sufficient for most cleaning applications.
- ❑ Minimize loading: Minimize the amount of solids and oils that enter your OWS. The less solids and oils that reach the OWS, the less frequently sludge and floating oil must be removed from the OWS and the better it will work. Also, minimize the amount of wash water reaching the OWS. Excessive water flow can flood an OWS, forcing wastewater through it too fast to allow separation. The result: oil and other contaminants pass right through to the sewer. OWSs should not be used to treat stormwater runoff.

Heavier or Lighter Than Water?

Question
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OWSs treat vehicle and floor wash water by allowing substances lighter than water to float and substances heavier than water to sink. Many OWSs also have baffles, coalescers, and oil skimmers to speed up or enhance separation of these substances.

How to Keep Oil and Solids Out

Filter, filter, filter. The best way to reduce OWS sludge is to keep solids out of vehicle and floor wash water. Install progressively finer grates and screens over the drains to the OWS inlet in order to maximize solids separation.

- ❑ Begin with steel bars spaced 3/4 to 1-inch apart at the OWS drain inlet.
- ❑ Add sequentially finer grates and screens (3/4 and 1/4-inch screens or 1/4-inch expanded steel mesh).
- ❑ Finish with reusable absorbent material to remove very small particles.

Bioremediation Benefits:

- ❑ Lower hydrocarbon levels in OWS effluent.
- ❑ Less contaminated sludge and lower volume of sludge.
- ❑ Reduction or elimination of odor.

Limitations of Bioremediation:

- ❑ Microbe populations can be killed by harsh chemicals or pH levels greater than 8.5; do not use detergents that are caustic or contain emulsifiers.

Recycling

Use Oil-Only Absorbents to Separate and Recycle Oil From Your OWS

It is not easy to collect and remove separated oil in some older OWSs. Use reusable absorbent pads that absorb only oil and grease if your OWS does not have an oil trough or other oil collection device. Put these pads on the water surface to collect floating oil, and squeeze the oil from the pads once saturated. This oil can then be managed with your used oil, if the squeezed oil is not contaminated with hazardous waste. (Obtain data on your wash water quality or analyze a sample at least yearly to verify). The squeezed absorbent pads can be reused.

Use Microbes to Digest Oil in Your OWS

Bioremediation is a proven technique to minimize the oil content in OWS effluent and sludge and to reduce OWS cleanout frequency. Microbes added to an OWS break down petroleum products suspended or dissolved in the wastewater, floating oil, or sludge. Facilities using bioremediation have eliminated wastewater violations and have reported reducing their sludge petroleum content by more than 80%. Such reductions can lower the regulatory status of OWS sludge, which will affect the required disposal method and disposal costs.

Bioremediation is typically performed under a vendor service contract. Microbes are added to an OWS or interceptor lines on a regular basis to replenish microbe populations. Microbes are nontoxic and completely safe; the main byproducts of

bioremediation are water and carbon dioxide. Vendor service contracts usually cover all materials and labor. Monthly costs range from \$75 to \$130, depending on the size and contaminant loading of the OWS.

Waste Management

Use simple methods to minimize engine and vehicle cleaning wastewater. Attach spring-loaded nozzles to hoses used for washing to prevent the hoses being left on when not in use. You can also use high-pressure spray units that use about half as much water as a garden hose and provide better cleaning. Wash water should be disposed of in a municipal sewer system.

Wash water can be collected and recycled if your facility is not connected to a sewer system. Water recycling systems are becoming more popular; facilities ranging from small self-serve car washes to large fleet operations have installed recycling systems.

DO:

1. Consider using a pressure washer or steam cleaner to wash engine compartments and vehicles. They use less water than a conventional hose.
2. Check with the local sewer utility or city engineering department to verify that your drains are connected to the sanitary sewer system.
3. Practice good housekeeping to minimize floor washing.
4. Use drip pans to catch leaks before they spill onto the floor. Dispose of the residue in the appropriate waste container.
5. Temporarily seal off floor drains to prevent a spill or leak from entering the drains.
6. Use a pressure washer or steam cleaner to wash down the shop area. They use less water than a conventional hose.
7. Use a non-toxic floor cleaner that meets local sewer facility standards. Be sure to obtain permission from your local sewer utility for your floor cleaning wastes to enter the sanitary sewer system.
8. Clean small, non-chlorinated spills immediately with absorbent. Collect and reuse absorbent material until ability to absorb is gone.
9. Use an oil/water separation system and maintain it regularly.
10. Have the sludge that gathers in oil/water separators tested to determine whether or not it is a hazardous waste.

11. Have the sump sludge tested when pumped out. Keep all testing records for three years.
12. Contract with a permitted hazardous waste hauler to manage sump sludge waste properly if it is determined to be a hazardous waste.

DO NOT:

1. Allow engine or vehicle cleaning wash water to flow into a septic tank or drain (inside or outside) leading to a storm sewer, ditch, stream, lake, or dry well.
2. Allow floor cleaning wash water to flow into a septic tank or drain (inside or outside) leading to a storm sewer, ditch, stream, lake, dry well, or the ground.
3. Put hazardous sump sludge in the trash dumpster or on the ground.
4. Use a septic tank pumping service to remove sump sludge.

Case Studies

Salem Boys Auto of Tempe, Arizona, used sloping pavement, grates, and screens to minimize OWS loading. These controls, together with bioremediation, decreased the sludge cleanout frequency and cost by 75 percent.

U.S. Postal Service Fleet Maintenance Facility, Huntington Beach, California, facility used bioremediation to reduce OWS effluent hydrocarbon concentration by more than 80 percent.

SOLID WASTE

Oil Filters

Oil filters filter out debris that oil picks up as it circulates through the engine. Oil filters become saturated with trapped debris and ultimately must be changed to avoid loss of filtering capability. Used oil filters normally contain some trapped oil, along with other contaminants that are potentially hazardous.

Problems

Environmental Impact

Question
97

Used oil filters may contain oil ("free liquid") and are certain to contain heavy metals. These can leach into waterways.

Worker Safety

No specific information available.

Regulations

Used oil filters may exhibit hazardous characteristics for lead, other heavy metals, and oil-based compounds. Used oil filters must either be managed as hazardous waste, or in accordance with the requirements found in the regulations outlined in the fact sheet. DTSC adopted special regulations in 1991 to encourage recycling of used oil filters and to protect public health and safety and the environment from potential hazards posed by disposal of used oil filters. These requirements are directed primarily at non-household generators of used oil filters, such as businesses and used oil collection centers. Used oil filters not managed as described in the fact sheet must be managed as fully regulated hazardous waste. Disposal of used oil filters in trashcans and at sanitary landfills is prohibited. Fuel filters, including fuel dispenser and diesel fuel filters, are not considered used oil filters and may not be managed in the same manner as used oil filters.

Solutions

Waste Reduction

Use Reusable Oil Filters

Fleet maintenance facilities generate hundreds of used oil filters every year from routine engine maintenance. These facilities thereby incur costs associated with maintaining filter inventory and managing and disposing of used filters. An alternative to conventional oil filters is reusable oil filters, which can last through the life of the

vehicle and eliminate the waste stream created by conventional disposable filters. You can save your facility money and reduce its impact on the environment by using reusable oil filters.

A reusable oil filter consists of an adapter plate; a canister; and a pleated, stainless steel, wire cloth filter. The wire cloth replaces the paper elements in conventional oil filters. Most filter parts last the lifetime of the vehicle. In comparison, conventional oil filters must be drained and either landfilled or recycled.

Will a filter fit any engine? Reusable oil filters are made to fit most vehicles. The adapter plate can be changed to accommodate different engine types, while the wire cloth filter inserts are often the same for vehicles of similar size. You can often replace multiple sizes of disposable oil filters with fewer replaceable filter inserts depending on your fleet. This makes stocking and ordering filters easier, saving you time and money.

How is the filter cleaned? The wire cloth filter is easily removed, cleaned in a parts washer, and replaced. Some vendors sell machines specifically for washing reusable oil filters. The cleaning time ranges from 5 to 15 minutes, and cleaning is usually performed when the oil is changed. How much does the filter cost? Prices for a reusable filter (including adapter plate, canister, and wire cloth filter) range from \$65 to \$130 for cars and small trucks and from \$120 to \$300 for large trucks.

What is the payback period? According to vendors and facilities using reusable oil filters, the payback period ranges from one to three years, depending on fleet size and oil change cycles. Savings are achieved by eliminating purchase and disposal costs for conventional oil filters.

Advantages of Reusable Oil Filters

Environmental

- ❑ Conserve oil, a non-renewable resource.
- ❑ Reduce potential for used oil contamination of groundwater, soil, and surface water.

Operational

- ❑ Reduce on-site filter inventory.
- ❑ Eliminate draining and crushing of used filters.
- ❑ Eliminate used filter storage and disposal.

Recycling

The first step in recycling an oil filter involves draining the remnant oil. Once most of the oil has been drained from the filter, it can be sent out for recycling. It is highly recommended that you arrange to have your drained filters removed by a recycling

service. Recycling of used oil filters is mandatory in several states and is increasing nationwide. A number of firms that pick up used motor oil, brake fluid, and used solvents also will remove used oil filters that are placed in collection drums provided for the purpose. Transmission filters may also be included in pickups by a recycling service. Two reasons that your shop should recycle used oil filters are:

Question
98

1. The oil that remains in drained filters and the steel comprising the filter housing are valuable resources that are otherwise thrown away. Approximately 90 percent of the used oil filters in the United States end up in landfills. This equals more than 17 million gallons of oil and 160,000 tons of steel going to waste. This is enough steel to build 16 new stadiums the size of Atlanta's Olympic Stadium.
2. A portion of the residual oil in a drained filter eventually drains from the filter into the landfill. Some of this oil will ultimately leach into the groundwater.

Waste Management

Used oil filters must be:

Question
99

- ☐ Drained of all free-flowing oil.
- ☐ Properly contained, labeled, and stored.
- ☐ Stored without exceeding allowed time limits.
- ☐ Transported to an allowed destination for purposes of metal reclamation.
- ☐ Transported under a bill of lading with a copy kept by the generator for three years.
- ☐ All used oil removed from the filters must be managed in accordance with all applicable requirements.

Draining

Used oil filters must be drained of all free-flowing used oil. "Free-flowing used oil" means the continuous stream of used oil flowing from the filter when it is inverted. Used oil flowing drop-by-drop is not considered to be free flowing. If the filter is equipped with a flapper valve or other device that impedes the drainage of used oil from the filter, that device must be manipulated to allow the used oil to drain freely.

Properly drained oil filters may be punctured, crushed, opened, further drained, or otherwise handled if the purpose of the treatment is to prepare the filters for recycling.

The treatment does not require a DTSC permit. The generator must properly manage all used oil and other residues generated from the treatment of the filters.

Used Filter Storage

Businesses or public agencies that accept used oil filters from householders must place the filters in containers upon acceptance to capture all used oil that separates from the filters. Upon reaching a location where proper drainage is practical, the filters must be contained as described ahead, and any used oil drained from the filters must be managed in accordance with all applicable requirements.

1. The drained filters must be contained in rainproof, non-leaking containers with tightly sealed lids.
2. Containers must be labeled "Drained Used Oil Filters," with the initial date of accumulation or receipt marked on each container.
3. The initial date of accumulation is the date when the first filter is placed in the container, or the date when a full or partially full container of filters is received at a second location.
4. Up to one ton of used oil filters may be stored for a period of up to one year, unless the storage facility has a hazardous waste permit authorizing longer storage of used oil filters.
5. Storage of one ton or more of used oil filters is limited to 180 days, unless the storage facility has a hazardous waste permit authorizing longer storage of used oil filters.

Allowed Destinations

The only allowed destinations for used oil filters are:

- ❑ To a smelter or scrap metal processor where used oil filters are recycled.
- ❑ To a municipal solid waste incinerator for energy recovery if the residual casings are subsequently transferred to a smelter or scrap metal processor for recycling.
- ❑ To a storage or consolidation facility that subsequently transfers the filters to a smelter, scrap metal processor, or municipal solid waste incinerator as described above.
- ❑ To an authorized hazardous waste facility.

Transportation

- ❑ Only properly drained filters may be transported.
- ❑ The containers must be tightly sealed during transportation to prevent any spillage of used oil.
- ❑ The containers must be well secured in the transport vehicle to prevent movement or tipping during transportation.
- ❑ A bill of lading must accompany each shipment of used oil filters, and must contain the following information:
 1. Generator's name, address, and telephone number.
 2. Transporter's name, address, and telephone number.
 3. Name, address and telephone number of the receiving smelter, scrap metal processor, municipal solid waste incinerator, or storage or consolidation facility.
 4. Quantity and size of containers in the shipment.
 5. Date of transportation.
- ❑ A copy of each bill of lading must be maintained by the transporter, generator, and receiving facility for three years.

Since May 1992, the U.S. EPA has exempted used oil filters from hazardous waste requirements provided that they are not constructed of tern plate steel (a lead/tin alloy, and not common) and that they are drained of oil while hot. The construction of most spin-on oil filters requires that the dome of the filter can be punctured to permit complete draining.

Used transmission filters are normally not a hazardous waste unless contaminated with certain metals such as cadmium and lead. Unlike oil filters, transmission filters do not retain fluid and, therefore, do not need to be crushed or split before being discarded. It is recommended that used transmission filters be recycled or reclaimed.

DO:

1. Drain, crush, split, or otherwise process used oil filters to remove all free oil from the filter. Be sure to drain remaining oil over an appropriate container.
2. Keep processed filters in a separate container that is clearly marked "USED OIL FILTERS."
3. Put oil drained from filters into your "USED OIL ONLY" container.

4. Contract with a service to remove your used oil filters for recycling.
5. Get a receipt for filters shipped and maintain records for at least three years.
6. Recycle transmission filters along with used oil filters if the recycling service allows this.
7. Locate a scrap metal recycler who will take the transmission filters if your oil filter recycler will not accept them.
8. Put transmission fluid drained from filters in your “USED OIL ONLY” container.

DO NOT

1. Discard undrained filters in the trash dumpster.
2. Discard drained filters in the trash dumpster without first making a hazardous waste determination and checking with the landfill that receives your waste to confirm if the facility accepts filters.

Fuel Filters

The fuel filter is solid waste that is often overlooked. Below are proper steps to follow to comply with regulations.

Problems

Some fuel is usually left inside when a filter is changed. You must take precautions to avoid fuel slippage or transfer to other waste streams.

Environmental Impact

The liquid fuel inside an old filter could become a part of other waste streams. The liquid will evaporate in time and this could also be considered an environmental issue. Return raw fuel back to the vehicle when possible.

Worker Safety

The main hazard to workers is the flammability of fuel. Exercise caution around any flammable material.

Regulations

Fuel filters are not specifically regulated.

Solutions

Waste Reduction

Use reusable filters when applicable.

Recycling

No recycling is possible other than adding filters to the used oil filter container after all liquid has been removed.

Waste Management

Add filters to the used oil filter container when all liquid has been removed.

Air Filters

Consider air filters when analyzing automotive waste streams, in keeping with the recycling concept.

Problems

Most air filters are paper and contain no pollutants. When other systems fail, such as the Positive Crankcase Ventilation System (PCV), large amounts of engine oil can soak into the paper element.

Environmental Impact

If the filter element is oil-soaked, disposing improperly could damage waterways.

Worker Safety

This is not an issue with air filters.

Regulations

Air filters are not specifically regulated.

Solutions

Waste Reduction

Use reusable filters when applicable.

Recycling

Recycling is not possible unless waste collection companies will take them as paper products.

Waste Management

Paper air filters can be disposed of in the regular trash collection system.

Oil Containers

Motor oil is a large part of the automotive world, and its containers must be handled properly.

Problems

Some oil containers contain “free liquid.”

Environmental Impact

The small amount of oil left in a container could find its way into waterways.

Worker Safety

No worker safety issues.

Regulations

All liquid must be removed from the container before disposal.

Solutions

Waste Reduction

Purchase oil in bulk containers.

Recycling

Most oil containers have a recycling symbol on them and should be diverted into the recycled plastic stream. Many waste haulers have special requirements for these containers.

Waste Management

Oil containers, or cans, are considered solid waste and can be disposed of via the traditional solid waste disposal methods. However, no “free liquid” can be left in a container. Thoroughly drain any residual liquid from a container before disposing of it. Easy-to-use drain stands are available commercially.

Question 100

Cans and Other Containers

These containers are part of our everyday world, not just the shop. Most people regularly recycle these containers at home, but recycling them in the workplace is also important.

Problems

The volume of cans and other containers in landfills is enormous. As landfills are closed, these waste streams must be increasingly diverted.

Environmental Impact

The need for raw materials to produce cans and other containers is an important issue, as is the energy required to create the final product.

Worker Safety

Can recycling does not affect worker safety.

Regulations

The disposing of these products is not regulated in most areas of the country.

Solutions

Waste Reduction

Use wise purchasing methods that include better product packaging, bulk packaging, and products made from recycled materials.

Recycling

Good recycling techniques are necessary for the typical wastes generated by human activities. Convenient locations should be available to collect aluminum cans, glass bottles, and other materials. Most local refuse collection agencies have containers available.

Waste Management

Use the recycling methods above.

Glass and Paper

The home environment is the place where this waste stream is usually being managed correctly. The shop must also consider this waste stream in its pollution prevention plan.

Problems

The volume of glass and paper in landfills is enormous. As landfills are closed, these waste streams must be increasingly diverted.

Environmental Impact

A major issue is the need for raw materials to produce glass and paper. Energy is required to create the final product.

Worker Safety

Glass and paper recycling do not affect worker safety.

Regulations

Disposing these products is not regulated in most areas of the country.

Solutions

Waste Reduction

Use wise purchasing methods that include better product packaging, bulk packaging, and products made from recycled materials.

Recycling

Good recycling techniques are needed for the typical wastes generated by human activities. Convenient locations should be available for glass bottles and recyclable paper waste. Most local refuse collection agencies have containers available.

Waste Management

Use the recycling methods above.

Asbestos

Asbestos has been banned from use in brake linings. Right? Wrong. Asbestos is still used in some brake and clutch linings and in other products. Recent newspaper articles, along with trade publications, have brought national attention back to asbestos and its potential health-and-safety issues.

Problems

Environmental Impact

The negative impact of asbestos is on humans. See worker safety below.

Worker Safety

Controlling Brake Dust to Protect Your Health

Mechanics and others working in a garage where brake and clutch work are done may be exposed to asbestos dust. Some brake dust is visible when a brake drum is removed from a car, truck, or other equipment. But many very small dust particles cannot be seen with the naked eye.

These invisible particles may be asbestos and/or other brake lining materials. Breathing these particulates can damage your health. This may cause shortness of breath, lung disease, or cancer many years after inhalation.

Asbestos is only one of many materials used in brake linings today. The only sure way to know what is in the dust from a particular brake is to test it in a laboratory. Newer brake lining materials are still being tested; caution is necessary.

The only practical way to protect your health and that of those around you is to limit the release of brake dust in your garage to the lowest possible level.

Question 101

Cleaning Methods that Release Brake Dust into the Air

Air Hose

Question
102

DON'T BLOW BRAKE DUST! NEVER USE AN AIR HOSE FOR CLEANING. This blows brake dust into the air in your garage, it is one of the worst things you can do, and it is illegal.

When brakes are cleaned with an air hose, invisible particles of brake dust can stay in the air long after the brake job is done. Any activity in the brake work area can stir up particles that have settled.

Other Methods that Release Brake Dust into the Air

You are advised not to clean with a dry brush or rag, wet brush or rag, garden hose, liquid squirt bottle, solvent spray, or ordinary shop-vacuum. These methods also stir up visible and invisible brake dust. Many of these dust particles are so small that they can pass through the filter bag of an ordinary vacuum cleaner and spread throughout a garage.

Regulations

A U.S. EPA rule, from July 1989, commonly known as the “Asbestos Ban and Phaseout Rule” (40 CFR 763 Subpart I, section 762.160–763.179) was set aside by the U.S. Fifth Circuit Court of Appeals in 1991. This ruling essentially negated the U.S. EPA ban on the U.S. manufacture, importation, processing, or distribution of many asbestos-containing products.

To follow up on the appeal to the original 1989 ban, the U.S. EPA published “Factual Determinations” in the Federal Register on Nov. 5, 1993 (58 FR 58964). The agency stated its position regarding the status of its ban on various asbestos-containing product categories. Here is an excerpt from that document:

Products Not Banned

Asbestos-containing product categories no longer subject to the 1989 Toxic Substances Control Act (TSCA) ban include: asbestos cement corrugated sheet, asbestos cement flat sheet, asbestos clothing, pipeline wrap, roofing felt, vinyl asbestos floor tile, asbestos cement shingle, millboard, asbestos cement pipe, automatic transmission components, clutch facings, friction materials, disc brake pads, drum brake linings, brake blocks, gaskets, non-roofing coatings, and roof coatings.

Asbestos is still out there, and you want to arm yourself with as much information as possible regarding health and safety, service procedures, and cleaning procedures. Check the “links” section for Internet-based resources you can turn to for more information.

Solutions

Waste Reduction

Purchase brake linings and pads that contain no asbestos.

Recycling

Return all pads and linings to parts suppliers for proper recycling.

Waste Management

Controlling Brake Dust

Vacuum/enclosure method: A vacuum/enclosure system has a special box with clear plastic walls or windows, which fits tightly around a brake assembly. Some boxes can even fit over a brake drum. Good brake cleaning can be done without exposing mechanics or contaminating a garage. A special air gun inside the box is used for cleaning. An exhaust hose goes from the box or drum to a special high efficiency particulate air (HEPA) filter asbestos vacuum cleaner (an extremely fine high efficiency particulate aerosol filtration system) that draws out and stores the brake dust.

The manufacturer's instructions should be carefully followed when using this system and changing the filters or collection bags. Improper changing can release dangerous amounts of asbestos into the air. Steps for using this type of equipment on drum brakes are simple:

1. Check to see that the hose is securely fastened to the HEPA vacuum container and to the brake enclosure. Also check the vacuum container seals and clips to make sure they are in proper functioning order according to the manufacturer's instruction.
2. Remove the wheel.
3. Turn on the asbestos vacuum cleaner.
4. Place the enclosure over the drum, being sure it forms a tight seal behind the backing plate.
5. Place hands into the attached rubber gloves, if the enclosure is equipped with them.
6. Remove the brake drum. Some equipment allows use of a hammer or other tools inside the enclosure when needed for drums that are hard to remove.

7. Blow dust off the drum and brake assembly using the air gun attachment inside the enclosure.
8. Clean all the inside surfaces of the enclosure toward the vacuum exit using the air gun attachment inside the enclosure.
9. Remove the enclosure and turn off the vacuum cleaner.

Wet Methods

Question
103

Use especially designed low-pressure spray equipment that wets down brake dust and properly catches the runoff and prevent some asbestos from spreading around a garage. Be sure to use only the liquid recommended by the manufacturer.

Waste

All waste that contains brake dust must be carefully disposed according to federal and local regulations for asbestos materials. OSHA asbestos waste disposal regulations are covered under 29 CFR 1910(j)(2). Transport and disposal of asbestos waste should be done only by individuals familiar with procedures for handling asbestos waste in accordance with U.S. EPA's waste disposal guidance (EPA/530-SW-85-007). Asbestos waste should be placed in an especially marked heavy plastic bag, double-tied, and stored in a leakproof, airtight container designated for asbestos waste. The waste should be brought to a landfill approved for asbestos disposal.

Machining and Beveling

Use pre-ground, ready-to-install parts. If a brake lining must be drilled, grooved, cut, beveled, or lathe turned, low speeds should always be used to keep down the amount of dust created. All machinery must have adequate HEPA-equipped, local exhaust dust collection systems to prevent asbestos exposures and shop contamination. BRAKE LININGS SHOULD NEVER BE GROUND—this creates too much dust. Slow lathe turning will do the same job with much less dust.

Special Areas for Brake Work

Where practical, brake work should be done in a special area set apart from other work areas. No one should eat, drink, or smoke in an area where brake work is done. Smokers who are exposed to asbestos, even while they are not smoking, are at especially high risk of developing lung cancer. Work clothes should be laundered at special facilities equipped to wash clothing contaminated with asbestos.

DO:

1. Clean brakes and drums with special "HEPA" vacuum cleaners.
2. Use pre-ground, ready-to-install parts when possible.
3. Lathe-turn brake blocks at a low speed with proper HEPA equipped exhaust.

4. Ventilate properly.
5. Dispose of asbestos waste according to federal and local regulations.
6. Wash thoroughly before eating or going home.
7. Change into clean clothes before going home.

DO NOT:

1. Clean with the following:
 - a. Air hose.
 - b. Liquid squirt bottle.
 - c. Dry brush or rag.
 - d. Wet brush or rag.
 - e. Solvent spray.
 - f. Ordinary shop-vacuum.
 - g. Garden hose.
2. Grind brake blocks.
3. Lathe, bevel, drill, or cut brake blocks without proper exhaust ventilation.
4. Take work clothing home.
5. Eat, drink, or smoke in work areas.

Brake Shoes and Pads

These products contain many hazardous materials. Their improper disposal can have a significant impact on the environment.

Problems

Environmental Impact

Brake shoes and pads can contain hazardous materials.

Worker Safety

See previous asbestos information.

Regulations

See previous asbestos information.

Solutions

Waste Reduction

Purchase brake linings and pads that contain no asbestos.

Recycling

Brake shoes are typically the most likely parts to contain these hazardous materials. The shoes are required to be returned to the parts supplier in order to receive credit for a “core charge.” The parts supplier then returns them to the rebuilder for reuse.

Waste Management

Brake pads are generally not subject to “core charges” and are usually disposed of in the solid waste stream. The best practice is to recycle them into the scrap metal stream.

Scrap Metal

Scrap metal refers to bits and pieces of metal parts (for example, rods, bolts, wheel weights) or metal pieces that may be combined together with bolts or solder (for example, radiators, scrap automobiles), which when worn or no longer needed, can be recycled. Some scrap parts contain lead, a well-known toxic substance and potential pollutant. Scrap catalytic converters contain platinum, a valuable, recyclable metal. Managing scrap safely will prevent contamination at your site.

Ferrous Materials

- ❑ Iron and steel—exhaust systems, engine parts, chassis parts.

Non-Ferrous Materials

- ❑ Copper—radiators, wires.
- ❑ Aluminum—Radiators, cylinders heads and blocks, alternators and starters, transmission cases.
- ❑ Lead—lead wheel (tire) weights and battery cable ends are common sources of lead. Lead is also found in radiators, heater cores, steering columns, soldered parts (such as circuit boards) and electronic components.

Combined Materials

- ❑ Catalytic converters.

Problems

Environmental Impact

Increased demand on natural resources and energy used to convert raw materials into final products.

Worker Safety

If you use a cutting torch, wear respiratory protection—such as a respirator with appropriate filters—to reduce the risk of breathing airborne lead that may be released by heating lead scrap.

TIP: Use a reciprocating saw rather than a cutting torch to remove lead portions from scrap parts, thus avoiding the generation of lead fumes.

NOTE: To avoid ingesting lead, wash well before eating or smoking after working with lead scrap.

Regulations

Divert scrap to scrap-metal dealers.

Solutions

Waste Reduction

Return worn-out parts to re-builders when possible.

Recycling

Some shops generate enough scrap metal to make it worthwhile to work directly with a scrap hauler. Others generate only small amounts of scrap and find their needs better met by taking their scrap to a local salvage business that will send it off for recycling. Keep copies of receipts and waste-tracking invoices on-site for at least three years from the date of shipment.

Waste Management

Good housekeeping practices send a positive message about a business. Manage scrap in a way that will neither detract from that message nor adversely impact the environment.

Prevent spills and manage them appropriately by draining fluids carefully before removing parts such as radiators or heater cores.

Store scrap items containing lead in a covered container that can handle the excessive weight of the lead. Mark the container “Lead Scrap.” This will help ensure that non-lead scrap is not mixed with it. Large scrap items, such as radiators that cannot be stored in a covered container, should be stored in a way that will prevent contact with rain, snow, and stormwater. Battery cable ends can be left attached to

the battery and recycled along with the battery. You should recycle lead parts with a metals or battery recycler.

Catalytic Converters

Store waste catalytic converters in a marked container to prevent mixing with other scrap. Recycle catalytic converters with an appropriate collection center.

Cores

Return core parts, such as alternators, master brake cylinders, starters, and brake pads to a parts supplier for rebuilding. Drain brake cylinders or any other part containing fluid well before returning them.

Other Scrap

Other scrap can be collected in a containment area suitable to your business. This includes copper wire, exhaust pipes, empty fuel tanks and miscellaneous clamps and fittings. (NOTE: Open burning laws prohibit burning insulation off copper wire.)

Lead-Acid Batteries

Question
105

More than 90 million batteries are manufactured in the United States every year. Lead-acid batteries provide the basis for the electrical system of all modern motor vehicles. These batteries rely upon two components to store energy and produce electricity: lead and sulfuric acid. Batteries pose a real threat to human health and the environment if improperly discarded.

Problems

Environmental Impact

Question
104

The corrosivity and heavy metal (lead) content of lead-acid batteries may endanger human health and the environment. Acid spillage from such batteries has contaminated many disposal sites with lead. Municipal solid waste landfills have banned spent lead-acid batteries. The plates of lead-acid batteries are made of lead, a poisonous metal. Even small amounts of lead in the body cause damage to the central nervous system, blood, kidneys, digestive system, and reproductive system. Lead is especially hazardous to children; even a minor concentration of lead in their blood impairs mental development. Sulfuric acid is a threat because of its highly corrosive nature. The acid from old batteries may also contain lead compounds, which pose an additional threat.

Worker Safety

Acid causes severe burns to the skin and eyes. Always use safety goggles and gloves when handling acid. The presence of other substances within an acidic mixture solution may cause the solution to be carcinogenic and very toxic.

Regulations

Do not dispose of batteries in a dumpster with other solid waste. State law prohibits this activity. The U.S. EPA declared automobile batteries a universal waste in 1985. By law, lead-acid batteries cannot be legally disposed of in landfills or incinerators; they must be recycled.

Solutions

Waste Reduction

Service batteries regularly and change them only when necessary. Encourage customers to use longer-lasting batteries. Recycle used lead-acid batteries.

Batteries not recycled must be disposed of as hazardous waste. Store and secure all batteries in a manner that prevents leakage of acid or hydrogen gas to the environment. Indoor storage on an acid-resistant rack or tub is recommended. Batteries stored outdoors should be kept on an impermeable surface such as a concrete slab that has secondary containment, and the storage area should be under cover to prevent acid runoff. Do not stack batteries—they may fall and crack. Inspect batteries weekly to ensure there are no leaks or cracks. Keep a neutralizing agent such as baking soda nearby in case of an acid spill.

Recycling

Fortunately, the main components of lead-acid batteries are materials that are both valuable and relatively easy to recycle. The typical battery contains 18 to 22 pounds of recoverable lead, a gallon of sulfuric acid, and three pounds of polypropylene casing. It is estimated that 80 to 90 percent of the lead-acid batteries discarded nationally are recycled.

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107

Question
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Waste Management

Lead-acid batteries are a characteristic hazardous waste because of the lead (D008) and acid (D002) content. However, batteries that are reclaimed are not considered hazardous waste and do not need to be counted in the quantity of hazardous waste generated per month. Batteries that are not reclaimed and are instead disposed as hazardous waste must be counted toward monthly generation and disposed at a permitted hazardous waste disposal facility.

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Question
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DO:

1. Store batteries upright in a secure, covered area on an impermeable (sealed) surface. Check often for leaks.
2. Label the storage area and containers, “UNIVERSAL, WASTE BATTERIES,” “WASTE BATTERIES,” or “USED BATTERIES.”
3. Recycle used, undamaged batteries as soon as possible. Store used batteries for no longer than one year.

4. Properly dispose of batteries by delivering them to the dealer from whom you purchased them, or to a collection center that sends batteries to a legitimate battery recycler.
5. Get a receipt when shipping batteries and maintain records for three years.
6. Promptly report any spillage from lead-acid batteries (due to dropping, etc.) to the U.S. EPA. Treat spills from lead-acid batteries as hazardous wastes.

DO NOT:

1. Place lead-acid batteries in garbage to be collected.
2. Dispose of lead-acid batteries in a landfill.
3. Burn batteries.
4. Stack batteries more than four high. They may fall and crack.
5. Store batteries outdoors unless protected from the weather.
6. Pour battery acid on the ground or into a drain.
7. Remove battery acid from batteries.

Tires

Scrap tire management is a serious concern. Discarded tires are one of the most difficult auto repair wastes to dispose. The solution for many years was to stockpile old tires in tire dumps. This has been going on so long that estimates of the number of tires stored this manner range from 750 million to 3 billion.

An additional 250 million tires are scrapped every year, with a portion of these added to the tire dumps. Many of the stockpiles continue to receive more scrap tires each year. (See Tables 1 and 2 in Appendix L for further information on scrap tire generation.) Most states have addressed scrap tire management through specific scrap tire laws and regulations or through state solid waste or transportation legislation.

Problems

Environmental Impact

Until 1985, most waste tires were buried in landfills or stockpiled at waste tire dumps. Tires are no longer buried at sanitary landfills since they do not easily compact or decompose, and they take up valuable landfill space. Tires disposed of in this way

present a potential fire hazard that could threaten natural resources by polluting air, soil, and water. Uncontrolled burning of tires releases toxins into the air, soils, and even groundwater. State law prohibits the open burning of waste tires. They burn very hot and are difficult to extinguish. They may pose a safety hazard for fire personnel and others in the area.

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Worker Safety

Discarded tires are an excellent breeding ground for disease-carrying pests and rodents. Just one tire left outdoors can retain enough rainwater to breed hundreds of thousands of mosquitoes, which have been known to transmit two strains of encephalitis—La Crosse and western equine.

Regulations

Since 1991, all land disposal of tires has been prohibited by State law due to the many environmental hazards created by burying, dumping, and the open burning of waste tires.

Appendix M has information on California's scrap tire management legislation and programs, with a matrix for each program. It provides California's regulators, as well as members of industry, with a quick reference to scrap tire programs.

The matrix for California's program contains eight sections. The "State Contact" section provides the general contact information for the scrap tire program manager for California. The "Legislation and Regulations" section briefly outlines the history of scrap tire legislation for California. The "Funding Sources/Fees" section addresses the State funds and collection fees authorized by the State. The "Collector, Seller, and Hauler Regulations" section summarizes the regulations that apply to these entities. Similarly, the "Storage and Processor Regulations" and the "Disposal Restrictions" sections outline relevant regulatory requirements. The "Financial/Market Incentives" section discusses grants and other programs that foster better scrap tire disposal/recycling waste management and reduction. The "Additional Information" section provides information about activities of interest—such as special field tests or studies, and innovative uses for scrap tires—related to scrap tires in a particular state.

Solutions

Waste Reduction

Prolong the life of your tires through proper maintenance. You will not only save money, but you will also reduce the number of tires that need to be recycled. Tires are designed to last up to 80,000 miles; however, most tire owners get less than half of this tire mileage. Proper tire maintenance improves gas mileage and provides better handling of your vehicle, saving you money.

Recycling

The Scrap Tire Management Council estimates that, in 1996, of the 266 million scrap tires generated in the United States, approximately 24.5 million were recycled for purposes such as ground rubber used in products and asphalt highways, stamped products, and agricultural and miscellaneous uses. An additional ten million were used beneficially in civil engineering projects. These civil engineering uses are presented separately from the recycling figure because, although some are recycled into products such as artificial reefs or septic system drain fields, many are used in landfill construction and operation. In addition, 152.5 million were combusted for energy recovery, and 15 million were exported. The remaining 64 million were landfilled or disposed in either legal or illegal stockpiles.

The reduce/reuse/recycle approach is slowing the rate at which tires are stockpiled. The design of all types of tires has advanced such that modern tires last considerably longer than those of just a generation ago; this has reduced the number of waste tires generated. Portions of the tires that are discarded are retreaded for reuse. Retreading is especially environmentally friendly with respect to energy conservation, since retreading a tire requires only about one-third of the crude oil needed to manufacture a new tire.

The bulk of the tires scrapped in the United States are recycled to recover their energy content. About 150 million tires are shredded and ground up annually to be burned together with other fuels in industrial facilities, including cement kilns, pulp and paper mills, and electricity generating stations. A smaller number (about 25 million per year) are used to make floor mats, shoe soles, electrical insulators, racetrack surfacing, and as an additive for asphalt used in paving, among other products.

Most tire dealers will accept your old tires for a small fee. Help protect the environment and pay the fee to ensure that your tires are disposed properly.

Check with the following for more information on disposal options:

- ☐ Your tire dealer.
- ☐ Recycling center.
- ☐ County sanitary landfill.
- ☐ County/city solid waste commission or agency.

What products are made from recycled tires?

- ☐ Fuel for power plants—mixed with coal, tire chips can provide a high-heat, low-emission fuel source.

- ❑ Construction material for filtration systems—shredded tires can be used in place of sand and gravel for foundation drainage, septic systems, and landfill construction projects.
- ❑ Playground and trail surfacing—granulated tires are used as a safe and soft covering for playgrounds, trail surfaces, and athletic tracks.
- ❑ Molded rubber products—belts, hoses, mats and surfacing tiles are made from finely ground "crumb rubber."
- ❑ Lightweight fill in construction projects.
- ❑ High-grade additive in the plastics industry (making products such as trash containers, landscape edging, pool decks, truck bed liners, muffler hangers, and rubber mats).
- ❑ Rubberized asphalt (used in road surfaces, parking lots, etc.).

Waste Management

Consider purchasing the highest quality tire you can afford. High demand/performance tires likely incorporate more natural rubber, which has greater tensile strength, resilience, and resistance to abrasions, impacts, and temperature changes. Other ways to get the most out of your tires:

- ❑ Buy smart—choose tires that fit your needs and car correctly.
- ❑ Inflate properly—under-inflation of your tires can result in lost tire life. Over-inflation can result in blowouts or uneven wear.
- ❑ Balance—keep tires balanced to avoid pulling them out of shape at high speeds.
- ❑ Rotate—rotating tires helps to distribute wear evenly.
- ❑ Alignment—improperly aligned tires can increase tire wear dramatically.
- ❑ Avoid sudden starts and stops—abrupt stops and starts cause rubber to wear off on the road surface.
- ❑ Stop-and-go traffic can wear tire tread seven times faster than steady driving.
- ❑ Avoid excess speeds—Driving at a high rate of speed causes heat to build up in the tire, rapidly deteriorating the rubber.

- ❑ Choose the best path to avoid road hazards and obstacles, or curbing and stops that could damage or puncture tire tread or sidewalls.
- ❑ Check the proper load rating and do not overstress tire capacity.

DO:

1. Contract for the proper disposal of scrap tires with a U.S. EPA approved vendor.
2. Assure that your scrap tires are disposed or recycled at a permitted facility.
3. Prevent the entrapment of water in tires by keeping them indoors or covered.
4. Know that all commercial haulers of scrap tires must have a carrier permit issued by the U.S. EPA.
5. Secure a scrap tire generator identification number from the U.S. EPA if you generate scrap tires.

DO NOT:

1. Accumulate more than 100 scrap tires without contacting the U.S. EPA.
2. Burn or bury scrap tires.

Absorbents and Used Rags

Minor spills and leaks of used oil and other liquids often occur at automotive service stations and other small businesses during activities such as vehicle maintenance, machinery repair, and fluid servicing. Cleaning up these spills and leaks generates used rags and other absorbents. Rags are also used to (1) apply cleaning solvents to parts and (2) wipe parts clean of dirt and excess liquids such as oils and cleaning solvents.

The two main types of absorbents are: (1) absorbent fabrics, which can often be laundered and reused, and (2) disposable granular absorbents. In addition to rags or towels, types of potentially reusable absorbent fabrics include the following:

- ❑ Pads
- ❑ Pillows
- ❑ Sheets, rolls, or blankets

- ❑ Booms
- ❑ Socks, tubes, or “pigs”

Disposable granular absorbents commonly used to clean up leaks and spills can consist of materials such as the following:

- ❑ Wood (chips or fiber)
- ❑ Paper (wipes or towels)
- ❑ Corncobs
- ❑ Plastic
- ❑ Peat
- ❑ Diatomaceous earth
- ❑ Sawdust
- ❑ Pumice
- ❑ Clay
- ❑ Rice and cottonseed hulls
- ❑ Cork

Absorbent fabrics can be wrung out, laundered, or pressed dry for reuse. Certain granular absorbents are made from recycled materials and can also be reused or burned for energy recovery. The appropriate absorbent for the shop depends on its specific needs; however, you should choose absorbents that can be recycled or have the potential for beneficial reuse whenever possible. Contact your local absorbent supplier for details.

Problems

Environmental Impact

Absorbents contain the liquids we are trying to keep out of the environment. They leech into waterways.

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Worker Safety

Absorbents pick up liquids that need to be disposed of but they do not change the chemical properties of those liquids. The absorbent still contains the chemical with its threatening health issues that the original liquid did.

Regulations

Spent absorbents are considered hazardous waste and must be disposed of according to local, State and federal regulations.

Solutions

Waste Reduction

Reducing the amount of used rags and other absorbents you generate is environmentally responsible and can save you money (for example, reduce disposal costs). The most effective way to reduce the amount of used absorbents that you generate is to reduce the number and quantity of spills, overfills, and leaks that occur during your operations. This can be accomplished by implementing the simple, low-cost pollution prevention (P2) ideas summarized below:

- ❑ Conduct routine inspections of liquid storage areas for leaks.
- ❑ Perform regular preventive maintenance of machinery, equipment, containers, and tanks, such as tightening and replacing leaky seals, gaskets, and dispensers.
- ❑ Train employees and implement good housekeeping measures.
- ❑ Use appropriate equipment for material storage and transfer such as containment pallets, funnels, and self-closing, non-leak faucets.
- ❑ Minimize the number of trips and distance related to material transfers to reduce the chance of accidental spills.

These ideas help reduce spills and leaks; however, spills and leaks are sometimes unavoidable and require cleanup. The additional P2 ideas summarized below help you reduce the amount of used rags and other absorbents generated during cleanup.

- ❑ Use drip pans under leaking cars, machinery, and pipes or under removed parts to catch liquids directly rather than cleaning them up with absorbents. The liquid could be reused or more easily recycled, particularly if you use separate drip pans for different liquids.
- ❑ Use a vacuum, squeegee, and dustpan, or dedicated mop to clean up most of a spill before using absorbents. The liquid could be reused or more easily recycled.
- ❑ Keep spill containment and cleanup materials in convenient areas and train employees when and how to use them.
- ❑ Store partially used absorbents in closed, labeled containers for reuse.

- ❑ Reuse or wring out absorbent materials using extraction devices such as centrifuges, wringers, or compactors to recover used oil and other liquids for reuse or recycling.

Recycling

Use the absorbent more than once. Keep a container of useable absorbent available. A saturated absorbent cannot be recycled; it must be handled as hazardous waste.

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Waste Management

Certain management requirements and exemptions apply to used rags that do not apply to other used absorbents. The easiest and most effective way to manage used rags is to launder them. Used rags that are laundered are not considered a solid waste or a hazardous waste. Therefore, testing of the rags and other hazardous waste requirements are not necessary. In addition, using a laundry service can save money by reducing rag purchase and disposal costs.

Contact a laundry service that cleans used rags to learn of any restrictions on the type or amount of contaminants on the rags it will accept. Laundry facilities will not accept rags that are saturated with hazardous waste. Make sure to use enough rags to avoid saturation. If you launder your own used rags in your shop, contact the facility that treats the wastewater to find out if it can accept the wastewater you discharge or if the wastewater needs some type of pretreatment. DO NOT launder your own used rags if your wastewater does not discharge into a treatment facility.

Used absorbents contaminated with hazardous substances other than used oil, especially solvents, paints, and inks, should be evaluated as potential hazardous waste and managed accordingly.

To effectively manage your used rags and other absorbents, keep used absorbents that contain hazardous materials separate from those containing non-hazardous materials. Store all absorbents in appropriately labeled containers. Do not dump excess liquid wastes into containers of used rags or other absorbents; instead, manage liquids separately.

Fluorescent Bulbs and High Intensity Discharge (HID) Lamps

Energy-efficient fluorescent lamps and high intensity discharge (HID) lights have gained widespread usage over the years as compared to incandescent ones. Fluorescent lamps and HID lights are three to four times more efficient in converting electricity to visible light.

Fluorescent and HID lamps contain mercury and in most cases are considered to be hazardous waste when disposed. Mercury is a metal that can accumulate in living tissue and cause illness or death in humans. When a lamp is broken or placed in a

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landfill or incinerator, the mercury can contaminate the air, surface water, and groundwater.

Problems

Environmental Impact

Fluorescent lamps and HID lights contain small quantities of mercury, cadmium, and antimony. An estimated 450—500 million fluorescent lamps and HID lights are disposed in the United States each year, dumping more than 30,000 metric tons of mercury-contaminated waste into the nation's landfills. Through improper disposal methods, mercury can travel from the soil to various water sources. Mercury has been found in lakes, rendering fish unsafe to eat. Concentrations of mercury in fish at one Minnesota lake have increased 5 percent a year since 1970, according to a Minnesota Pollution Control Agency study. As mercury moves up the food chain, it becomes more concentrated. In concentrated form, it is poisonous to the human nervous system.

Worker Safety

The materials contained within the bulbs are very hazardous. Never break bulbs deliberately and never breathe the vapors or dust given off during a break.

Regulations

For the latest developments in federal regulations call:

Toxic Substance Control Act Assistance Information Hotline (202) 554-1404
Resources Conservation Recovery Act Hotline 1-800-424-9346

In California, the Cal/EPA Department of Toxic Substances Control regulates the management of spent fluorescent light tubes and spent mercury vapor lamps as hazardous wastes. Mercury is listed as a hazardous waste under Title 22, California Code of Regulations, section 66261. The spent tubes and lamps typically contain enough mercury to qualify as toxic hazardous wastes under Title 22, CCR, section 66699.

Spent fluorescent tubes, as well as other hazardous wastes including nickel-cadmium batteries and mercury thermostats, are regulated as universal wastes. Universal wastes are generally lower risk, are generated by a large number of people, and are subject to reduced management requirements. Small businesses are exempt from many of the requirements until 2006. The management and handling requirements for universal wastes can be found in the DTSC fact sheet "Managing Universal Waste in California" at http://www.dtsc.ca.gov/PublicationsForms/HWM_FS_UWR.pdf.

Solutions

Waste Reduction

You are highly encouraged to recycle your mercury-containing lamps rather than dispose of them. Contact the DTSC duty officers for a list of lamp recyclers at http://www.dtsc.ca.gov/Flyers/OAD_fly_Domap.pdf.

These recycled lamps will not count toward your facility's hazardous waste generator status. However, if the lamps are determined to be hazardous and you choose to dispose them in a hazardous waste landfill, they will count toward your facility's hazardous waste generator status.

DO:

1. Recycle your fluorescent and HID lamps. Recycled lamps will not count toward your facility's hazardous waste generator status.
2. Store lamps in a manner that will prevent them from breaking. The original shipping container works well for this purpose. Label the container(s) holding unbroken lamps, "WASTE MERCURY-CONTAINING LAMPS" or "USED MERCURY-CONTAINING LAMPS," and mark on the container(s) the date you began storing the lamps.
3. Store used lamps for no more than one year.
4. If lamps are broken, store them in a tightly sealed container marked, "WASTE BROKEN MERCURY-CONTAINING LAMPS."
5. Determine the hazardous waste category of mercury-containing lamps if you choose not to recycle your lamps. Do dispose of your lamps in a hazardous waste landfill if they are found to be hazardous. These lamps will count toward your facility's hazardous waste generator status. If these lamps are found to be non-hazardous, they may be disposed with your regular trash.
6. Use a bill of lading or non-hazardous manifest to document the amount of used lamps shipped off-site for recycling. Keep copies of any shipping papers for at least three years.
7. Consider using fluorescent or high intensity discharge lamps containing less mercury.

DO NOT:

1. Place used lamps for business, industry, or institutions in the regular trash until they are determined to be non-hazardous.
2. Intentionally break or crush lamps, because mercury may be released.

3. Tape lamps together for storage or shipment. This may cause them to break.

Recycling

Check with local waste haulers to see if they can provide recycling containers.

Waste Management

Proper disposal: The State of California and the U.S. EPA classify mercury as both hazardous and toxic. Fluorescent lamps and HID lights often contain more than three times the concentration of mercury allowable for landfill disposal in California.

Disposal of spent tubes and lamps at a designated hazardous waste landfill can be costly and lead to increased liability in the long run.

Under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the U.S. EPA, Cal/EPA, and courts can hold any individual or corporation liable for cleanup of a hazardous waste site regardless of the extent of their contribution. The risk of being a potentially responsible party is causing many generators, including small businesses, to look for alternatives to landfill disposal.

Some generators have turned to incinerators as a disposal option. Once the lamps are heated, these incinerators can emit mercury vapors that can travel more than 200 miles, increasing the area of mercury contamination. The U.S. EPA reported that the 187 incinerators nationwide emit approximately 70,000 pounds of mercury each year.

A good alternative is to recycle mercury-containing lamps and tubes. Several companies in California process and recycle spent fluorescent lamps and HID lights. In choosing one, take the following precautions:

- ☐ Look for a company that has been approved by the Cal/EPA.
- ☐ Ask for its U.S. EPA ID number. Remember, sending hazardous waste to an unauthorized facility is like pouring it down the drain—both are illegal!
- ☐ Use lighting service companies that provide certification showing proper disposal of fluorescent tubes and lamps waste. If it is not following proper disposal methods, you, as the generator, can be held responsible.
- ☐ Employees handling the change-out of the spent tubes and lamps should be familiar with hazard communication laws.

Off-site alternatives: Lighting Resources, Inc., disassembles the lamp and mechanically separates the materials with the help of proprietary equipment. Aluminum end caps are mechanically removed from the intact fluorescent lamp. The aluminum is then sent for recycling. A vortex of air is induced into the lamp to separate the mercury from the lamp phosphor. The remaining glass is now

environmentally clean and is recycled by a local company. Mercury not recovered at the facility is sent for processing in a vacuum mercury retort recovery still and is fully recycled.

Aerosol Cans

Quite a number of cleaners, paints, and adhesives used in auto repair are packaged in aerosol spray cans. These cans are thin-walled steel pressure vessels pressurized with one of several hydrocarbon propellants, such as butane. When empty, the propellant and product are gone and the cans are not considered hazardous wastes. However, partially empty spray cans may be regulated as hazardous wastes because they contain ignitable or chlorinated solvents.

Aerosol cans are expensive and have greater environmental consequences. Ounce for ounce, spray-on product sold in aerosol cans is roughly twice the cost of bulk product. You pay for the propellants in every aerosol can you purchase. Most aerosol cans contain 10–15 percent propellant by weight.

Problems

Environmental Impact

Carbon dioxide, propane, and butane are commonly used aerosol propellants. These are “greenhouse gases” that contribute to global warming and smog formation. Every year, individual auto repair and fleet maintenance facilities discard hundreds—sometimes thousands—of aerosol cans as trash, taking up valuable landfill space. These cans dispense brake cleaners, carburetor cleaners, lubricants and penetrants, engine degreasers, and numerous other products.

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Pressurized cans present additional environmental concerns. If punctured, contents may be released so forcefully that injuries could result. Extreme temperatures may cause cans to rupture, and moisture may cause them to rust, releasing the contents with potential to harm the air, water or land. Pressurized cans sent to a landfill present safety concerns during compacting, and fire hazard becomes more acute if container contents are vacated using an aerosol-puncturing device for the purpose of disposal.

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Worker Safety

Some aerosol products such as paints, solvents, and pesticides are hazardous. Most aerosol cans pose a fire hazard because they contain highly flammable propellants such as propane and butane. Aerosol products must be used with adequate ventilation and/or personal protective equipment to prevent inhalation, employee exposure, and potentially harmful health effects. (Always check the material safety data sheet for proper usage and follow the directions!)

Regulations

U.S. EPA and many states may consider used aerosol cans that are not empty to be hazardous waste.

Required Paperwork

- ❑ Purchasing—request an MSDS for all aerosol products. Occupational Safety and Health Administration (OSHA) regulations require products to have these data sheets. (Hazard information should also be provided in foreign languages for employees who may not understand English.)
- ❑ Storage—inspect all hazardous waste storage areas and document inspection results.
- ❑ Shipping—keep shipping papers/manifests for a minimum of three years to show waste has been shipped properly.
- ❑ Disposal—know where waste is going. Request proof that the waste has been received and disposed of or recycled properly. Keep records for a minimum of three years.

Solutions

Waste Reduction

First, determine whether or not a material is even needed. Could the entire process using the aerosol be eliminated? If required, choose a non-hazardous product or the least hazardous product that will do the job (an MSDS is one helpful resource). Use only the amount of product needed. Store aerosol products in a dry area not subject to extreme temperatures. Follow label directions to clean the nozzle after use to prevent clogging. Use up products before buying others. To apply paints, use a brush instead of an aerosol, or consider electrostatic painting, when possible.

Refillable Spray Bottles

Shops and facilities that switch to refillable spray bottles are saving money by avoiding the high cost of aerosol cans. They are helping to protect the environment by eliminating the solid and potentially hazardous waste stream they produce.

Two basic types of refillable spray bottles are:

1. Metal bottles that spray product using compressed air.
2. Plastic bottles that use a hand pump to spray product.

Refillable metal bottles more closely resemble aerosol cans in terms of their design and performance. These bottles are filled with product (for example, brake cleaner) from a bulk container and are pressurized with air at 80 to 200 pounds per square inch

using a compressed-air hose. Plastic bottles are also filled from bulk containers but do not require compressed air. Instead, the user pumps a trigger to create a mist or stream of product.

What to Consider When Selecting Refillable Spray Bottles:

Capacity. The capacity of air-pressurized, refillable spray bottles varies from 7 fluid ounces to 1 quart. Smaller bottles are useful for spraying hard-to-reach areas. Larger bottles are more convenient because they require less frequent filling and therefore less technician time.

Construction material. Refillable spray bottles are available in different materials and with different finishes (aluminum, stainless steel, brass, and steel) for use with different types of bulk product. Ask the spray bottle manufacturer whether the bottle is compatible with the product you intend to use.

Nozzle type. 1-quart, refillable spray bottles come with standard spray and stream nozzles. A nozzle that can be adjusted from stream to spray is also available. Smaller bottles (16 and 8 fluid ounce) are available that closely resemble the size and shape of aerosol cans and have a spray pattern similar to an aerosol can spray.

Nozzle extensions. Nozzle extensions up to 12 inches long are available for spraying areas that are otherwise difficult or impossible to reach.

Cost. Air pressurized, refillable spray bottles cost from \$25 to \$60 each, depending on the construction material. Chemically resistant plastic bottles and hand pumps cost from \$1 to \$6 each. Be sure to check with the product vendor about plastics that are compatible with their chemical product.

Economy. Ounce for ounce, bulk product is cheaper than aerosol cans. Most common spray-on products are available in containers ranging in size from 1 to 55 gallons. You may be able to obtain free refillable spray bottles from your vendor when you purchase their product.

Maximizing benefits. Refillable spray bottles do work and can reduce costs, if they are used correctly. Therefore, be sure to:

- ❑ Avoid product losses due to spills during refilling. Use funnels and pumps to minimize spills.
- ❑ Keep replacement parts on hand. Small, inexpensive parts such as nozzle seals, filler caps, valves, and nozzles may deteriorate with repeated use and pressurization.
- ❑ Refillable spray bottles will be used if they are as convenient for workers as aerosol cans; therefore, provide every technician with a refillable spray bottle for each type of frequently used aerosol product.

- ❑ Water in the shop air lines may cause corrosion in some steel refillable spray bottles. Ensure that your shop air supply has a water removal device.

Local air district requirements. Check with your local air quality district if using VOC solvents in your refillable spray bottles, some have restrictions on use.

OHSA labeling. The contents must be labeled on each can according to OSHA regulations.

Recycling

Under the federal Resource Conservation and Recovery Act (RCRA), aerosol cans may be recycled if they have been emptied through normal use or punctured and drained to remove significant liquids. Some states, including California, have more stringent regulations than RCRA. Be sure to investigate State regulations before recycling aerosol cans. Shops are responsible for properly managing any captured wastes recovered from puncturing and draining.

Although spray cans may be discarded in the trash, they are recyclable because the majority of the can is steel. In fact, the typical spray can contains at least 25 percent recycled steel. A number of recyclers that collect drained oil filters for recycling will also accept empty spray cans along with the filters. The oil filters and spray cans are shredded and melted down to make new steel.

Waste Management

Managing Empty Aerosol Containers

“Empty” means the can contains no product and no pressure. Empty containers are exempt from hazardous waste rules. They have no special storage, labeling, or disposal requirements. Recycle them, if possible, or send them to an incinerator that will recover the metal. If you have a small number of empty aerosol containers, you may be able to mix them with your solid waste. Check with your solid waste handler first.

Managing Non-Empty Aerosol Containers

First, try to return or exchange malfunctioning aerosols. Malfunctioning aerosols returned to the supplier or manufacturer are considered “product,” not “waste.” Hazardous waste rules do not apply. You must follow applicable state and federal requirements for transport. Non-empty aerosols that cannot be returned or exchanged must be managed as a hazardous waste or may be managed as universal waste. Regardless of the contents, most aerosols are hazardous because they are ignitable (D001) due to the type of propellants used.

Storage and Labeling of Waste Aerosols

Waste aerosols whose contents (including propellants) are non-hazardous have no hazardous waste storage requirements. Follow fire protection requirements for product storage. Store hazardous waste aerosols in a closed container marked with the following:

- ❑ The words “Hazardous Waste.”
- ❑ A clear description of the waste.
- ❑ The accumulation start date (the date you first placed waste in the container).

If you have only a few aerosol cans, you may mark them individually as outlined above, and place them in a fire-safe storage cabinet. You may designate a special cabinet for waste, or reserve and mark a special section of your product cabinet for waste. If storing incompatible materials, store them in separate containers (such as plastic dish pans) within the waste storage area. Perform and document weekly inspections of the waste.

Disposal / Recycling Options

Non-empty aerosol cans, even though they have been determined to be non-hazardous, have few disposal options. They generally cannot be sent to a landfill or a solid waste incinerator. They will probably need to be managed by a company specializing in hazardous and problem waste disposal.

Aerosol cans that contain hazardous product or propellant should be shipped to a hazardous waste facility for proper disposal. Conditionally exempt small quantity generators (CESQGs) have the additional option of taking waste aerosol cans to a CESQG collection site, if they are permitted to accept from CESQGs.

Companies that regularly have significant numbers of similar waste aerosols may be interested in using an aerosol-puncturing device. If you choose to use one, below are some precautions to keep in mind.

DO:

1. Follow the manufacturer’s instructions for operating, cleaning, and maintaining the puncturing device.
2. Only thoroughly trained staff should be operating the device containing the appropriate cartridges. They should wear appropriate personal protective equipment—tyvek body suit, nitrile gloves, full-face respirator (or half-face respirator with safety goggles and face shield). **WARNING:** The major propellants of aerosol cans (propane and butane) are extremely flammable. A filter unit does not capture them. The propellants vaporize quickly into the surrounding air, producing a flammable hazard. Smoking

should not be allowed in or near the puncturing area. To prevent static sparks, ground steel containers before you begin to fill them.

3. Sort cans by size and puncture similar sizes at the same time. You may wish to puncture cans containing solvents, degreasers and/or lubricants last to help clean the puncturing unit.
4. Operate only in an open, well-ventilated area. Avoid confined spaces.
5. Collect liquids in an appropriate, marked and labeled hazardous waste container, such as a rust-free drum with a bung opening that can be fitted with a pressure release valve.
6. Use up the contents of an entire spray can before starting another. Make sure that the aerosol is completely empty before discarding it by using a tool to puncture the can and capture any remaining contents.
7. Return to the seller any spray cans that malfunction (for example, the tip breaks off).
8. Use refillable mechanical spray cans when possible. Consider phasing out the use of spray cans in your shop. You may realize a large savings by switching to non-aerosol products.
9. Establish a distribution control system to limit aerosol cleaner use.
10. Consider phasing out the use of spray cans in your shop.
11. Store your empty spray cans along with your drained and crushed oil filters for pickup and recycling.

DO NOT:

1. Spray in or around other solvents. Hazardous contamination may result.
2. Empty the contents of spray cans by releasing into the environment.
3. Discard partially empty spray cans into the trash dumpster.
4. Puncture aerosol cans containing any of these ingredients: ethyl ether (often found in starting fluids), chlorinated compounds, pesticides, freons and foamers, oven cleaners, or unknowns.

These types of aerosols should be lab-packed and managed as hazardous waste.

GASEOUS WASTE

Refrigerants

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All but the newest designs of vehicle air conditioners use CFC-12 as a cooling agent. CFC-12 is one of the chemicals known to destroy the ozone layer, our planet's protection against harmful rays from the sun. This has led to the phasing out of CFC-12 from usage in the modern automobile. How does the CFC phaseout affect a vehicle?

The phaseout of the substance means that production will stop. It does not mean that one has to stop using or having the air conditioner serviced with CFC-12. The first important step for all vehicle owners with CFC-12 air conditioners involves reducing unnecessary loss of refrigerant. Preventive maintenance, fixing leaks, and recycling at service are key actions to minimize the need for additional refrigerant after the phaseout of production at the end of 1995.

But many vehicles with CFC-12 air conditioners may require service past that date. What choices will these vehicle owners have? For vehicles under warranty, please consult your dealer. For vehicles not under warranty, you have the choice to either continue to service your air conditioner with CFC-12, have the vehicle modified to use HFC-134a, or use another EPA-approved refrigerant.

Despite the halt in production of CFC-12, government and industry are developing programs cooperatively to ensure that some supply of this refrigerant will be available after 1995. While the available supply will be limited and the costs will certainly rise in the future (in part due to a federal tax on CFCs), for many vehicle owners the option of continuing to use CFC-12 may be the most attractive one.

Other owners may decide to have their air conditioning units modified to accept alternative refrigerants. For example, if you are having major service performed on your CFC-12 air conditioner, modifying the system to use HFC-134a or another refrigerant may be appropriate.

The automobile manufacturers are working diligently to identify the required procedures for each of their models that would permit the use of HFC-134a while maintaining reliability and cooling performance. Make sure that your service center uses the manufacturer's recommended alternative refrigerant and follows their recommended procedures. Using substances that have not been thoroughly tested may cause performance and safety problems and void your warranty.

Since the complexity and the cost of modifying a CFC-12 system will vary by make and model of car, the decision to retrofit may make more sense for some vehicles than others. In many cases, retrofit of newer vehicles will require fewer changes and cost

less than retrofit of older vehicles. Actual costs of modifying a system to accept an alternative may vary widely.

If you are considering the purchase of a new or used vehicle, ask if the air conditioner uses HFC-134a. If not, find out about any applicable warranties covering air conditioning service and repair. If you are concerned that the air conditioner might need service after the warranty has expired, you may want to consider buying an "extended warranty" or service contract that covers the air conditioning service costs. EPA and the automotive industry are working together to make the transition away from ozone-depleting chemicals as smooth as possible, but we need your support and cooperation to make this effort a success.

Problems

Environmental Impact

Scientists worldwide have concluded that chlorofluorocarbons (CFCs, also known by the trade name Freon) deplete the ozone layer. CFCs have been used in the manufacturing of many products, such as foam insulation, electronics equipment, refrigerators, and air conditioners. When allowed to escape, these chemicals drift some 30 miles above the Earth to the stratospheric ozone layer—a layer of gas that screens us from the sun's powerful ultraviolet (UV-B) radiation. Once there, CFCs break apart—a process that releases chlorine, which then attacks ozone. A single chlorine atom can destroy more than 100,000 ozone molecules.

The ozone layer is being depleted over Antarctica (known as the Antarctic ozone hole), but also to a much lesser extent over North America, Europe, and other populated areas. A depleted ozone layer allows more UV-B radiation to reach Earth, harming human, animal, and plant life in many ways. Scientists around the world agree that increased UV-B radiation could eventually cause a rise in cases of skin cancer and cataracts. Also, increased radiation could damage important food crops and marine ecosystems.

Worker Safety

Refrigerants have a very low boiling point. Any exposure to the skin or eyes by liquid refrigerant can result in frostbite or permanent damage such as blindness.

Refrigerants, when burned, release toxic fumes. Avoid the introduction of refrigerant into a running engine's intake system. The gases exiting from the exhaust are poisonous. HFC-134a is also flammable at high temperatures. Keep refrigerants away from hot areas such as exhaust manifolds and welding equipment.

Regulations

The U.S. and more than 150 other countries are working together to protect the ozone layer by phasing out the production of ozone-depleting substances in developed countries. In addition, the Clean Air Act of 1990 contains requirements that ban the release of refrigerants during the service, maintenance, and disposal of air

conditioning and refrigeration equipment and for labeling of products that are manufactured with or contain CFCs. Shops are required by law to use approved recovery or recycling equipment when servicing air conditioning systems. Also, the technicians must be certified in the proper use of the equipment.

The Legal Status of Recycling of Blend Refrigerants

As of June 1, 1998, U.S. EPA allows recycling of refrigerant blends used in motor vehicle air conditioning systems (MVACS), provided that recycling equipment meets a new Underwriters Laboratories (UL) standard and refrigerant is returned to the vehicle from which it was removed.

The U.S. EPA has worked closely with the industry to ensure the purity of recycled CFC-12 and HFC-134a. as provided by strict adherence to standards first established voluntarily by the Society of Automotive Engineers (SAE) and later incorporated into U.S. EPA regulations. In contrast, because such standards did not exist for blend refrigerants, technicians could recover them and send them to a reclaimer, but they could not recycle such blends. As explained in a letter to refrigerant manufacturers dated October 16, 1996:

"Service shops may either recover HFC-134a or recycle it using special recycling equipment in the shop. Currently, however, it is not legal to recycle any other alternative MVAC refrigerant. [U.S.] EPA's policy is that until a standard for equipment designed to recycle a particular refrigerant is published and available (by EPA or an industry organization like SAE or UL), then it is illegal to recycle that refrigerant."

U.S. EPA has worked with UL and the MVAC industry since that letter was sent to develop a standard for blend recycling equipment. On May 29, 1998, UL adopted Standard 2964: Recover/Recycling Equipment, and announced that it will accept equipment for certification testing. UL also solicited any additional comments that might be appropriate. If, after receiving comments, UL publishes an amended standard, the new version will govern equipment certification. Standard 2964 includes numerous requirements for recycling equipment to guarantee that recycled blend refrigerant is similar in purity to recycled CFC-12 or HFC-134a. U.S. EPA believes that recycling equipment meeting this standard will adequately remove oil, water, and other impurities. Under this standard, technicians will follow similar procedures for recycling pure refrigerants, such as CFC-12 and HFC-134a, and blend refrigerants.

One key difference between pure refrigerants and blends is that blends may fractionate, meaning that it is impossible to predict in advance what composition will remain in the system after a leak. Because there is no means by which to guarantee the proper composition of a recycled blend, U.S. EPA believes it is appropriate to recharge such refrigerant only into the original vehicle. U.S. EPA is not allowing recycled blend refrigerant to be recharged into a vehicle other than the one from which it was removed. The only exception is for fleets of vehicles with a common owner. Recycled blend refrigerant may be moved among vehicles within such a fleet.

Recycling blend refrigerants used in MVACS using equipment certified to meet UL 2964 is now legal, provided that the refrigerant is returned to the original vehicle. Under the Significant New Alternatives Policy (SNAP) program, U.S. EPA has provided consumers with numerous options to replace CFC-12. This new policy will ease the servicing of vehicles using blend refrigerants. If you have questions about blend recycling, please contact the U.S. EPA's Stratospheric Ozone Protection Hotline at 1-800-296-1996.

See Appendix N for more information on the regulation of various refrigerants and the processes that handle them.

Solutions

Waste Reduction

All automakers are responding to the CFC production phaseout by beginning to produce vehicles with an alternative refrigerant called HFC-134a. This refrigerant does not deplete the ozone layer because it does not contain chlorine. By the end of 1994, virtually all new cars, trucks, and vans were equipped with HFC-134a air conditioning systems.

Recycling

You can help save the ozone layer by getting professional vehicle service at a shop that uses recycling equipment and by having leaking systems repaired. Recycling and leak repair help to conserve CFCs and limit the release of the chemicals to the environment.

Recycling vs. Reclamation

Recycling is the use of a machine to remove impurities and oil and then recharge the refrigerant into either the same car or a different car. Recycled refrigerant is not as pure as reclaimed refrigerant. Recycling occurs in the service shop.

Reclamation means the removal of all oil and impurities beyond that provided by on-site recycling equipment. Reclaimed refrigerant is essentially identical to new, unused refrigerant. Reclamation cannot be performed in the service shop. Rather, the shop generally sends refrigerant either back to the manufacturer or directly to a reclamation facility. The facility reprocesses the refrigerant to at least the purity specified in Air-Conditioning and Refrigeration Institute (ARI) Standard 700-1993. This is verified with a laboratory analysis. In general, reclamation involves the use of processes or procedures available only at a refrigerant reprocessing or manufacturing facility. A list of certified reclaimers is available through the U.S. EPA.

Waste Management

Effective July 1, 1992, section 608 of the Clean Air Act prohibits individuals from knowingly venting ozone-depleting compounds (generally CFCs and HCFCs) used as refrigerants into the atmosphere while maintaining, servicing, repairing, or disposing of

air conditioning or refrigeration equipment (appliances). Only four types of releases are permitted under the prohibition:

1. "De minimis" quantities of refrigerant released in the course of making good faith attempts to recapture and recycle or safely dispose of refrigerant.
2. Refrigerants emitted in the course of normal operation of air conditioning and refrigeration equipment (as opposed to during the maintenance, servicing, repair, or disposal of this equipment) such as from mechanical purging and leaks. However, U.S. EPA requires the repair of leaks above a certain size in large equipment.
3. Releases of CFCs or HCFCs ***that are not used as refrigerants***. For instance, mixtures of nitrogen and R-22 that are used as holding charges or as leak test gases may be released because in these cases, the ozone-depleting compound is not used as a refrigerant. However, a technician may not avoid recovering refrigerant by adding nitrogen to a charged system. Before nitrogen is added, the system must be evacuated to the appropriate level. Otherwise, the CFC or HCFC vented along with the nitrogen will be considered a refrigerant. Similarly, *pure* CFCs or HCFCs released from appliances will be presumed to be refrigerants, and their release will be considered a violation of the prohibition on venting.
4. Small releases of refrigerant that result from purging hoses or from connecting or disconnecting hoses to charge or service appliances will not be considered violations of the prohibition on venting. However, recovery and recycling equipment must be equipped with low-loss fittings.

DO:

1. Recycle CFC-12 and substitute refrigerants on the premises using EPA-approved recycling/recovery equipment with a certified operator. Recover/recycle equipment and recover-only equipment must meet SAE Standard J-1990 and J-2209, respectively.
2. Keep records of the dates and quantities of CFC-12 recovered and recycled.
3. Make sure technicians are trained and certified by a U.S. EPA-approved organization.
4. Keep records of any shipments of recovered CFC-12 refrigerant.
5. Learn the federal regulations governing the use of alternative refrigerants.
6. Manage filters from Freon recovery equipment as a hazardous waste.

DO NOT:

1. Evaporate or vent Freon or substitute refrigerants to the atmosphere.
2. Perform service on motor vehicle air conditioners without the proper refrigerant recovery/recycling equipment. You must recover/recycle all refrigerants used in MVAC systems.
3. Recharge a vehicle's system with recovered CFC-12 or substitute refrigerant that has not been recycled on-site or by a refrigerant reclamation facility.

Volatile Organic Compounds/Solvents

Volatile organic compounds (VOC) are found in many cleaning solvents, spray cleaners, and other processes used in the automotive industry. VOCs originate from many organic chemical-manufacturing processes as well as from paint spraying, coating, printing and cleaning activities. They are particularly prone to loss from spills, leaks and handling, hence the expression "fugitive emissions." There are two major areas that are causes for concern: personal health hazards and environmental damage.

Question
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Problems

Environmental Impact

The release of certain VOCs into the air is a contributor to the rapid thinning of the world's ozone layer. VOCs also contribute toward ground-level photochemical smog, a major health hazard, and some contribute to global warming. Organic solvents can also be hazardous for soil and water.

Question
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The daily use of VOCs can be hazardous for the user and the environment through emissions in air, water, and soil. Organic solvent emission is a major factor in the buildup of atmospheric ozone (Los Angeles smog), a powerful irritant gas that affects the mucous membrane and respiratory tract and may be carcinogenic. Other environmental hazards include ozone depletion in the stratosphere caused by certain organic solvents (that is, chlorinated hydrocarbons).

Worker Safety

The occupational exposure effects of organic solvents include damage to liver, kidneys, and lungs, degreasing of the skin and dermatitis, mild and reversible effects on the nervous system, and more severe effects from large acute exposure. Other effects include irreversible damage to the central nervous system, such as dementia due to long-term occupational solvent exposure. The VOCs react with oxides of nitrogen in air, in the presence of sunlight, to produce ozone. This is a reactive free-radical compound that is associated with aggravating the effects of asthma and other respiratory illnesses. Organic solvents are also hazardous since they are explosive and flammable.

Traditional solvents are volatile. When inhaled, the vapor or gas goes into the lungs. This substance is taken up by the blood and transported directly to the brain within 20 seconds and then is transported to the rest of the body. Since organic solvents dissolve fat and the brain and nerves are 99 percent fat, the result is clearly damaging.

Extent of the damage to humans depends on length of time exposed to the vapors, their intensity, type of solvent (some are utterly aggressive) and the degree of sensitivity of the individual body. Eventually, volatile organic solvents will cause a series of symptoms with the generic name of organic psycho syndrome (OPS) divided into four stages. The longer a person works with solvents, the stronger the effects. Occasional contact with volatile solvents leads to the first stage below. The other three occur with regular use of these solvents. Effects include:

1. Headaches, irritations, maybe an occasional high (like kids sniffing glue). Duration equal to solvent exposure.
2. Depression, irritation, fatigue, loss of concentration—lasts for days to weeks. Recovery is possible.
3. Fatigue, depression (strong feelings of melancholy), constant irritation, loss of memory (short-term), loss of concentration (especially difficulties with reading text), problems with orientation, problems with sleeping lasting months to years. Recovery is possible but some effects are permanent.
4. Change of personality, dementia, and paralysis.

Question
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Please see earlier section on cleaning liquids and the effects of n-Hexane. Also, see Appendix K for additional information on n-Hexane.

Solutions

Waste Reduction

In many cases it is possible to replace highly volatile organic solvents with cleaning agents that are made from fatty acid esters of vegetable oils. The development of these vegetable cleaning agents in the printing industry has led to a major innovative push in cleaning technology. Initial tests in other industries have shown that fatty acid esters may be suitable for a wide variety of purposes. Emission free, non-toxic and environment friendly cleaning agents are prerequisites for the technology of the future.

Recycling

VOCs are hazardous waste and must be treated as such.

Waste Management

Spent VOCs must be handled as hazardous waste.

APPENDICES

Appendix A—Toxicity Characteristic Hazardous Waste
Appendix B—Listed Hazardous Wastes
Appendix C—Hazardous Waste Generator Requirements
Appendix D—Oil Related Rules, Guidelines, and Legislation
Appendix E—A History of Automotive Oil
Appendix F—Automotive Lubricant Information
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Appendix K—Information About N-Hexane Use
Appendix L—Scrap Tire Information
Appendix M—California Scrap Tire Information
Appendix N—Handling Refrigerant
Appendix O—Environmental Regulations History Overview
Appendix P—Create an Oil Life Extension Program at Your Facility
Appendix Q—U.S. EPA Waste Codes—F List
Appendix R—The National Fire Protection Association (NFPA) Hazardous Rating

Appendix A—Toxicity Characteristic Hazardous Wastes

Contaminant	U.S. EPA Hazardous Waste Number	Contaminant	U.S. EPA Hazardous Waste Number
Arsenic	D004	Hexachlorobenzene	D032
Barium	D005	Hexachlorobutadiene	D033
Benzene	D018	Hexachloroethane	D034
Cadmium	D006	Lead	D008
Carbon Tetrachloride	D019	Lindane	D013
Chlordane	D020	Mercury	D009
Chlorobenzene	D021	Methoxychlor	D014
Chloroform	D022	Methyl ethyl ketone	D035
Chromium	D007	Nitrobenzene	D036
O-Cresol	D023	Pentachlorophenol	D037
M-Cresol	D024	Pyridine	D038
P-Cresol	D025	Selenium	D010
Cresol	D026	Silver	D011
2,4-D	D016	Tetrachloroethylene	D039
1,4-Dichlorobenzene	D027	Toxaphene	D015
1,2-Dichloroethane	D028	Trichloroethylene	D040
1,1-Dichloroethylene	D029	2,4,5-Trichlorophenol	D041
2,4-Dinitrotoluene	D030	2,4,6-Trichlorophenol	D042
Endrin	D012	2,4,5-TP (Silvex)	D017
Heptachlor	D031	Vinyl Chloride	D043

Appendix B—Listed Hazardous Wastes

Used solvents, solvent distillation residues (also known as “still bottoms”), or mixtures containing solvents are often hazardous waste. This includes solvents used in degreasing parts washers, used paint thinners, and distillation residues from reclamation. The following table cites listed hazardous wastes commonly generated by the auto repair industry.

U.S. EPA Hazardous Waste Number	Hazardous Waste
F001	The following used solvents used in degreasing: tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, chlorinated fluorocarbons; all used solvent mixture/blends used in degreasing containing before use, a total of 10% or more (by volume) of one or more of the solvents listed above or those listed in F002 and F005; and still bottoms from the recovery of these listed solvents and used solvent mixtures.
F002	The following used solvents: tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2- trifluoroethane, ortho-dichlorobenzene, trichlorofluoromethane, and 1,1,2-trichloroethane; all used solvent mixture/blends containing before use, a total of 10% or more (by volume) of one or more of the solvents listed above or those listed in F001 and F005; and still bottoms from the recovery of these listed solvents and used solvent mixtures.
F003	The following used solvents: xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all used solvent mixture/blends containing before use, one the above used solvents; and all used solvent mixtures/blends containing, before use, one or more of the above solvents, and a total of 10% or more (by volume) of one or more of the solvents listed in F001, F002, and F005; and still bottoms from the recovery of these used solvents and used solvent mixtures.
F005	The following used solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol and 2-nitropropane; all used solvent mixture/blends containing, before use, a total of 10% or more (by volume) of one or more of the above solvents or those listed in F001 and F002; and still bottoms from the recovery of these used solvents and used solvent mixtures.

Appendix C—Hazardous Waste Generator Requirements

Task	CESQG <100 kg	SQG >100 kg <1,000kg	LQG >1,000 kg
Identify the hazardous wastes present.	♦	♦	♦
Obtain a U.S. EPA identification number.		♦	♦
Package wastes in DOT-approved containers.		♦	♦
Label drums with words identifying what the waste is or with a hazardous waste label during satellite accumulation.		♦	♦
Keep satellite accumulation drums closed and secure unless you are adding or removing waste.		♦	♦
Once the satellite accumulation drum is full, place a hazardous waste label on it, fill in the date, and move it to the hazardous waste storage area within three days (make sure the label is completely filled out at this time).		♦	♦
Store the wastes on-site for no longer than 90 days.			♦
Store the wastes on-site for no longer than 180 days (270 days if transporting to a disposal facility 200 or more miles away).		♦	
Never accumulate more than 13,200 pounds of hazardous waste on the property.		♦	
Never accumulate more than 2,200 pounds of hazardous waste on the property.	♦		
Inspect container storage area weekly and/or inspect tanks daily and keep a log.		♦	♦
Manifest all hazardous wastes using the Uniform Hazardous Waste Manifest.		♦	♦
Eligible for consolidated manifesting of specified waste streams.	*	*	
Attach a Land Disposal Restriction (LDR) Notification form to each hazardous waste manifest to notify the permitted Treatment, Storage, and Disposal (TSD) Facility of LDR requirements for the waste.		♦	♦

Task	CESQG <100 kg	SQG >100 kg <1,000kg	LQG >1,000 kg
Post the following information next to the telephone in the hazardous waste storage area: name and telephone number of the emergency coordinator; location of fire extinguishers; spill control materials; fire alarm location (if present); and fire department number.		♦	
Designate an emergency coordinator and devise a contingency plan and personnel training program (must be written).			♦
Retain copies of all signed manifests for at least three years from the date of transport.		♦	♦
Retain copies of any test results, waste analyses, or other determinations for at least three years from the date of transport.		♦	♦
Retain copies of LDR determinations, notifications, and waste analyses for at least five years from the date of transport.		♦	♦
Submit a report every two years summarizing the types and quantities of hazardous wastes used, methods of disposal, and efforts made toward waste minimization and the results of those efforts.	*	*	♦
Dispose of all hazardous wastes at a permitted TSD facility or a permitted HHW small business collection facility.	*	♦	♦
Pay Hazardous Waste Management Fees	*	♦	♦

Appendix D—Oil Related Rules, Guidelines, and Legislation

Test Procedures and Labeling Standards for Recycled Oil

The Federal Trade Commission (FTC) in accordance with section 383 of the Energy Policy and Conservation Act of 1975 (EPCA), promulgated a rule prescribing test procedures and labeling standards for recycled oil.

Effective November 30, 1995, the rule:

- ❑ Defines recycled oil as processed used oil that the manufacturer has determined is substantially equivalent to new oil (produced from crude) for use as engine oil.
- ❑ Adopts the test procedures for all engine-lubricating oils identified in the American Petroleum Institute (API) Engine Oil Licensing and Classification System (EOLCS) Publication 1509.
- ❑ Determines that to demonstrate the substantial equivalency of recycled oil with new oil, manufacturers must use the EOLCS test procedures.
- ❑ Allows a manufacturer or other seller to represent, on a container of processed used oil, that such oil is substantially equivalent to new oil for use if it can demonstrate that the recycled oil is substantially equivalent to new oil manufactured from crude.

This rule does not require manufacturers to label motor oil made from re-refined base stocks as either "used" or "re-refined." However, in order for a manufacturer to claim, on a label, that the product is substantially equivalent to new oil, the manufacturer must base that claim on the oil meeting API standards.

California Senate Bill 734

Senate Bill 734 (Rosenthal, Chapter 959, Statutes of 1993), which became law on January 1, 1994, mandates that the State of California purchase re-refined automotive lubricants. These lubricant products must be available in fitness and quality equal to that of their non-recycled counterparts, and they must not cost more than 5 percent of the lowest vendor quoted price for recycled products.

The State of California also requires recycled automotive lubricants to contain a minimum of 70 percent re-refined oil to count toward the State's mandated goals or to qualify for the State price preference. These lubricants include, but are not limited to, crankcase oil, engine oil, transmission fluid, and power steering fluid. The recommended minimum content standard refers only to the base oil fraction. It is based on the higher California 70 percent standard because products with 70 percent re-refined base oil are available on the West Coast.

U.S. EPA Guideline for Purchasing Re-Refined Lubricating Oil

In 1988, the U.S. EPA issued a guideline for purchasing re-refined lubricating oils. The purpose of the guideline is to increase the use of re-refined lubricants by both the

government and private sectors. The guideline requires all federal agencies and all state and local government agencies and contractors that use federal funds to purchase such products, to implement a preference program that favors the purchase of re-refined oil to the maximum extent practicable. The procurement guideline also states that procuring agents should not require lubricating oil containing re-refined oil to meet any performance standard higher than that required of virgin lubricating oils.

U.S. EPA recognizes API specifications as those that should be met by any oil, either from re-refined or virgin base stock. U.S. EPA recommends that procuring agencies set a minimum re-refined oil content standard of 25 percent of the base stock for purchasing engine lubricating oils, hydraulic fluids, and gear oils.

Public Contract Code Article 2.1: Recycled Fluids, Paints, and Solvents

Article 2.1 as added by SB 734:

12170. Fitness and quality being equal, all state agencies shall purchase the following products whenever available:

- (a) Re-refined automotive lubricants, including, but not limited to, crankcase oil, engine oil, transmission fluid, and power steering fluid, for all state vehicles, including but not limited to, all fleet cars, trucks, and buses, so long as the cost of the refined automotive lubricants is not more than 5% greater than the lowest price quoted by suppliers offering non-recycled lubricant.
- (e) "Fitness and quality" shall be defined in this section as meeting all specifications required of the product for its specific use including those of a manufacturer's warranty.
- (g) "Re-refined motor oil" shall be defined in this section as having a neutral oil content consisting of at least 70% re-refined oil.

Article 4. Recycled Materials, Goods, and Supplies:

12210.

- (a) Fitness and quality being equal, all local and state public agencies shall purchase recycled products instead of non-recycled products whenever available at no more than the total cost of non-recycled products. All local public agencies may give preference to the suppliers of recycled products. All local public agencies may determine the amount of this preference.

Article 7.6 Recycled Oil Markets:

10409. Every local agency, as defined in section 17518 of the Government Code, shall purchase lubricating oil and industrial oil from the seller whose oil product contains the greater percentage of recycled oil, if the availability, fitness, quality, and price of the recycled oil product is otherwise equal to, or better than, virgin oil products. This section shall not prohibit a local agency from purchasing virgin oil

products for exclusive use in vehicles whose warranties expressly prohibit the use of products containing recycled oil.

White House Executive Order

President Bill Clinton signed into law the Federal Acquisition, Recycling, and Waste Prevention Executive order in 1993. The law details federal government support for recycling and waste prevention through a series of mandates. The mandates, in summary, are as follows:

1. The head of each Executive agency shall incorporate waste prevention and recycling in the agency's daily operations.
2. The order created a Federal Environmental Executive responsible for the implementation of the order.
3. Waste prevention and recycling shall be considered in acquisition planning for all procurements.
4. Where applicable, Executive agencies shall review and revise federal and military specifications, descriptions, and standards to enhance Federal procurement of products made from recovered materials.
5. Contracts that provide for contractor operation of a government-owned or leased facility, shall include provisions for contractor's compliance with the order.
6. Executive agencies shall ensure compliance with provision of the order in the acquisition and management of owned and leased space.

The full text of the Executive order can be found on the Internet.

Appendix E—A History of Automotive Oil

Oil Field Production

Oil seepage from fissures in the ground and oil bubbling up in spring-fed ponds have been observed for centuries. An oil-fouled stream known as “Oil Creek” in Titusville, Pennsylvania, was the site of the first viable oil well in the U.S. The first person to pump commercial quantities of oil from an underground source was E. L. Drake, who drilled this well in northwestern Pennsylvania in 1859. Modern wells can be thousands of feet deep. When drilling operations pass through aquifers, they can contaminate the ground water supply they contain.

Ordinary oil well recovery methods extract only about one-third of the oil potentially available at a specific site. This inefficiency has led to the development of enhanced oil recovery techniques. One technique (“water-flood” method) involves pumping water into an oil reserve under pressure. The water sweeps or pushes a large portion of the remaining oil toward the producing wells. This technique can result in a significant increase in the potential for ground water pollution.

Oil Shale

Another oil production technique is the extraction of oil from oil shale. On the average it is necessary to process one ton of shale for every 25 gallons of crude oil. Current technology requires a large amount of water and generates a significant quantity of solid waste (tailings). The water utilized in extracting oil from oil shale becomes contaminated and cannot currently be recycled because of the chemicals it contains.

Offshore Fields

Oceanic pollution problems can arise from attempts to drill for oil in offshore deposits. 20,000 offshore wells have been drilled since 1947.

- ❑ In Santa Barbara, California, a 1969 oil rig leak caused great damage to marine habitat and recreational beaches.
- ❑ A 1977 North Sea oil well blowout in late April created a 20-mile slick.
- ❑ A Mexican offshore oil well blowout in 1979 in the Gulf of Mexico contaminated Gulf fisheries and beaches with an estimated 3.5 million barrels of oil.

Leakage, blowouts, and accidents in offshore drilling operations can create a severe problem for marine life. For example:

- Oil penetrates into the feathers of aquatic birds, making flight impossible due to the added weight.
- The oil, lighter than water, floats on top, forming a film and severely affecting marine plants that also concentrate on the surface.
- Oil can act as a solvent to other substances. Pesticide DDT is 100 times more soluble in oil than in water.

Transportation

Supertankers, barges, pipelines, railroad tank cars, and highway tank trucks transport petroleum. All of these conveyances are prone to accidents, spills, and leaks. The grounding of the Exxon Valdez spilled more than 11 million gallons of crude oil into Alaska's Prince William Sound in 1989. Large towed oil barges are used extensively for the transportation of petroleum in the Great Lakes and the 30,000 miles of U.S. inland waterways.

Notable Oil Spills

<i>Gallons</i>	<i>Place</i>	<i>Ship Name</i>	<i>Cause</i>	<i>Date</i>
20,000,000	Galicia, Spain	Prestige	Weather	Nov. 14, 2002
26,000,000	Off Shetland Islands	Braer	Grounding	Jan. 5, 1993
21,500,000	Off N. Spain	Aegean Sea	Unknown	Dec. 3, 1992
13,524,000	Off South Africa	World Glory	Hull failure	June 13, 1968
68,700,000	Off Brittany, France	Amoco Cadiz	Grounding	Mar. 16, 1978
10,700,000	Galveston Bay, Tex.	Burmah Agate	Collision	Nov. 1, 1979
10,080,000	Prince William Sound	Exxon Valdez	Grounding	Mar. 24, 1989
7,700,000	Nantucket, Mass.	Argo Merchant	Grounding	Dec. 15, 1976

Whenever a large spill occurs on a waterway, it must be contained as rapidly as possible. Spills on water are typically surrounded by a floating sorbent encased in a fabric to form a sausage-like shape that can act as a barrier, a "boon," that does not allow the oil to spread. The cleanup of an oil spill can be extremely difficult because oil can spread on water to 0.01 inches thick over a 25-square-mile area in less than 8 hours.

Below are the processes for collecting oil spilled onto water:

- ☐ Vacuum recovery.
- ☐ Gelation—convert the oil from a liquid to an organic gel.
- ☐ Bioremediation.
- ☐ Skimmers.

Within the U.S. territorial limits, the U.S. Coast Guard has the responsibility for oil spill control.

Appendix F—Automotive Lubricant Information

Engine Oil

Automotive engine oil has several important jobs within the engine. The oil must provide a fluid film between all moving engine parts to reduce friction, heat, and wear. Friction and wear are caused by metal-to-metal contact of the moving parts. Wear is also caused by acidic corrosion, rusting, and abrasion from contaminants carried within the oil.

Automatic Transmission Fluid

Automatic transmission fluid is developed as a result of the petroleum fractionating process. It is one of the most complicated of the automotive fluids due to the large variety of functions it must perform. In addition to its various functions, the automatic transmission contains a variety of internal components that require either constant lubrication or fluid to transmit a hydraulic force. Internal components could include clutches, servos, valve bodies, bearings, and pumps.

In a typical automatic transmission, a pump circulates the transmission fluid to the various components. Automatic transmission fluid is manufactured with a red dye in order to differentiate automatic transmission fluid from other fluids. Several types of fluids are manufactured for use in automatic transmissions. Letters printed on the container identify the fluids. Automatic transmission fluid base is developed through the petroleum fractionating process. Automatic transmission fluid may not be included in all recycling programs. Generally, it can be mixed with engine oil as part of an oil recycling or re-refining process.

Manual Transmission Gear Oil

Most manual transmissions utilize helical-cut gears; most of them are lubricated with SAE 90 hypoid gear oil. The gear's constant rotation is sufficient to splash lubricating oil up and around the inside of the transmission casing. Lubrication by splash is adequate to ensure that gear faces and bearings are protected. There are exceptions to the use of hypoid gear oil in transmissions. Some British sports car transmissions use SAE 30 engine oil. Other transmissions may require automatic transmission fluid. Heavy, thick hypoid gear oil should never be used with this type of lubrication requirement. Manual transmission fluid is developed through the petroleum fractionating process. The fluid is generally included in all recycling programs. It can be mixed with engine oil as part of an oil recycling or re-refining process.

Differential Gear Oil

Most differentials use SAE 90 hypoid gear lubricant, which has a strong sulfur-like odor. This special gear lubricant allows for the proper meshing of the offset pinion and ring gears. If anything other than the gear lubricant is used, the differential will quickly fail. Some differentials use a lubricant other than SAE 90 hypoid gear oil. A limited-slip differential utilizes a special lubricant that works with the internal clutch discs located in the differential. Differential fluid is developed through the petroleum

fractionating process. The fluid is generally included in all recycling programs. It can be mixed with engine oil as part of an oil recycling or re-refining process.

Power Steering Fluid

Most power steering systems use hydraulic power. These systems use a power steering pump driven by a belt from the crankshaft. The pump moves fluid under pressure through hoses to the steering gear. The pressure is used in the steering gear to reduce steering effort. A reservoir for fluid is typically attached to the rear of the pump. The fluid used in the power steering system must be the correct type of fluid. Older vehicles use automatic transmission fluid in the power steering systems. New vehicles use specially developed power steering fluid. The new power steering fluids are often a different color than the automatic transmission fluids to facilitate leak detection. Power steering fluid base is developed through the petroleum fractionating process. The fluid is generally included in all recycling programs. It can be mixed with engine oil as part of an oil recycling or re-refining process.

Additives

Automotive fluids can contain a variety of additives. The types and quantity of these additives can be adjusted to produce oils that meet various service requirements. The additives include:

- ❑ **Metallic Detergents:** These are metallic ash-containing compounds having a detergent/dispersant action in controlling deposits and keeping engine parts clean. The compounds have the ability to clean up existing deposits as well as disperse particulate contaminants in the oil. Metallic detergents are the main reason oil can control acidic corrosion. They also maintain excellent anti-wear, anti-scuff, and anti-rust characteristics.
- ❑ **Ashless Dispersants:** These are ashless organic compounds that have a detergent/dispersant action in controlling deposits and keeping engine parts clean. Their cleanup action is much more effective than metallic detergents in suspending potential carbon-forming deposits in the oil. As the performance of ashless dispersants continues to improve, they are slowly replacing metallic detergents.
- ❑ **Oxidation Inhibitors:** Oxidation inhibitors prevent oxygen from attacking the lubricant base oil. Without inhibitors, the oil would react with oxygen, eventually thickening or turning acidic and causing bearing corrosion.
- ❑ **Bearing Corrosion Inhibitors:** Bearing corrosion is the result of acid attack on the oxides of the bearing metals. The acids involved originate either from the blow-by combustion gases or from oxidation of the crankcase oil. Acidic corrosion is controlled by the addition of inhibitors, which form protective barrier films on the bearing surfaces.
- ❑ **Rust Inhibitors:** Rusting results from an oxygen attack on a metal surface and usually occurs in thin film areas, such as hydraulic lifters and push rods. It is controlled by the addition of an inhibitor to the oil formulation.
- ❑ **Anti-Wear:** Wear results from metal-to-metal contact, acidic corrosion, and contaminant or dirt load. Metal-to-metal contact is overcome by the use of

film-forming compounds. The acidic corrosion, originating mainly from acidic blow-by gases, is neutralized by the use of alkaline additives.

- ❑ **Foam Depressants:** Detergent/dispersant type oils tend to accumulate air. When rapidly released, air causes foaming. Foam depressants are added to control the release of accumulated air, thus eliminating the problem.
- ❑ **Pour Point Depressants:** Pour point refers to the lowest temperature at which the oil will flow when tested under prescribed conditions. Base oils contain hydrocarbons that tend to solidify or crystallize into waxy materials at lower temperatures. Use of pour point depressants in the oil formulation modifies the wax crystal structure, resulting in a lower pour point. In some instances, this improves low temperature fluidity.
- ❑ **Viscosity Index Improvers:** Petroleum oils thin out with increasing temperatures. Viscosity index is a measure of this rate of viscosity change. The addition of a viscosity index improver slows down the rate of oil "thinning," and the oil remains thicker at engine operating temperatures. Viscosity index improvers are used extensively to formulate multi-grade oils. Additives include: colloidal graphite, colloidal molybdenum disulfide, and soluble friction modifiers.

Appendix G—The Rebuttable Presumption

HSC 25250.1(a)(1)(B)(v) 66279.10

Used oil handlers (for example, generators, used oil collection centers, transporters, transfer facilities, and used oil recycling facilities) are required to determine whether the total halogen content of each used oil shipment exceeds 1,000 parts per million (ppm). Used oil containing more than 1,000 ppm total halogens is presumed to have been mixed with halogenated hazardous waste. Used oil must be managed as a RCRA hazardous waste unless it can be demonstrated not to have been mixed with halogenated hazardous waste (i.e., unless the presumption is rebutted). This is a “rebuttable presumption.”

The “Rebuttable Presumption” Works as Follows in California

Generators, transporters and used oil collection centers are required to test or apply knowledge to determine whether a used oil shipment has a total halogen content over or under 1,000 ppm. If a generator, transporter, or used oil collection center chooses to apply knowledge to determine that used oil does not contain more than 1,000 ppm total halogens, this must be done in accordance with criteria specified in 66279.10(a)(1)(B) for generators, 66279.10(a)(3)(B) for transporters, and 66279.10(a)(6) for used oil collection centers.

Used oil transfer facilities and used oil recycling facilities are required to test each shipment of used oil for total halogens before accepting the shipment, 66279.90(a).

If it is determined that the used oil shipment contains greater than 1,000 ppm total halogens, used oil is presumed to have been mixed with halogenated hazardous waste and must be handled as RCRA hazardous waste, unless the presumption is rebutted.

In order to rebut the presumption that the used oil shipment was mixed with RCRA hazardous waste, the used oil handler must demonstrate that the used oil was not mixed with halogenated hazardous waste. Where this demonstration is successfully made, the used oil is regulated as used oil. The rebuttable presumption is deemed rebutted for the following types of used oils where specified conditions 66279.10(b) are met: metalworking oils or fluids containing chlorinated paraffins, refrigeration oils contaminated with chlorofluorocarbons, used oil which is exclusively household “do-it-yourselfer” used oil or used oil from a conditionally exempt small quantity generator. (A conditionally exempt small quantity generator generates no more than 100 kilograms of RCRA hazardous waste in a month and does not accumulate more than 1,000 kilograms of hazardous waste on site at any time, 40 CFR 261.5).

Appendix H—Re-Refined Oil—Closing the Loop

An estimated one-third of the hazardous waste generated in California is used oil. Most of this waste is generated at vehicle service/repair businesses. These millions of gallons of waste oil represent a major disposal problem and potential environmental threat if improperly handled. The volume of used oil being recycled continues to increase as more companies recognize the need and benefits of properly managing and recycling used oil.

The Used Oil Project

State environmental regulatory agencies are working together to encourage this trend. In 1993, the Department of Toxic Substances Control (DTSC), in partnership with the California Integrated Waste Management Board (CIWMB), started the Used Oil Project. The focus of the program is to assure that used oil generated in California is managed properly. The project, which is funded through an oil disposal fee paid by consumers, ensures that all authorized used oil recycling facilities throughout the state are held to the same regulatory standards and requirements.

Re-refined Oil Vs. Virgin Stock

There are a number of economic, environmental, and technical reasons why re-refined oil is slowly gaining a share of the lubricating oil market in the U.S. Re-refined lubricating products are often competitively priced, meet demands of environmentally concerned consumers, and achieve the same quality standards as new oil manufactured from crude. Federal, state and local governments, the U.S. Postal Service, and many private companies are using re-refined lubricants in a range of vehicles, from passenger cars to heavy equipment vehicles.

Refining technology has advanced from the days when used oil was reclaimed by removing water, dirt, sludge and some volatile compounds. Used oil that is re-refined undergoes a manufacturing process similar to new oil made from crude. Key components of the re-refining process include vacuum distillation and hydrotreating. In the U.S. and Canada, three companies use the Mohawk technology: Mohawk, Safety-Kleen, and Evergreen, to produce re-refined base stocks.

Testing—Standards

Lubricating oils made from re-refined base stocks must undergo the same testing and meet the same standards as those from new base stock in order to receive the American Petroleum Institute (API) certification mark of approval. Vehicle and engine manufacturers such as Ford, Chrysler, General Motors, Mercedes Benz, and Detroit Diesel have issued warranty statements that allow the use of re-refined oil as long as it meets API standards.

The National Bureau of Standards, the U.S. Army, the Department of Energy, the U.S. Postal Service, and the U.S. EPA have completed studies on the use of re-refined oil.

These studies have concluded that re-refined oil is equivalent to virgin oil, that it can pass all prescribed tests, and that it occasionally outperforms virgin oil. The chemical composition of re-refined oil and virgin oil are so similar that a chemical analysis lab would conclude that they are identical.

Economic and Environmental Benefits

The National Recycling Coalition indicates that if all Americans collected used oil for refining, it would keep 35 million cars running smoothly for a year, reduce dependence on foreign oil, provide jobs for Americans, and reduce our trade deficit by \$150 million.

An important environmental reason for re-refining used oil is the fact that oil is a non-renewable resource. Re-refining extends the life of a non-renewable resource by converting it back into a usable product that can be recovered again and again. Increased demand for re-refined oil can create a greater demand for the proper collection of used oil and diminish irresponsible dumping since the improper disposal of used oil contributes to soil contamination and surface and groundwater pollution.

Re-refining is also an energy efficient method of managing used oil. Less energy is required to produce a gallon of re-refined base stock than a gallon of base stock from crude oil. Approximately 100 gallons of crude oil is required to make nine gallons of neutral base stock. Re-refining 100 gallons of used motor oil recovers almost 65 gallons of re-refined base stock, more than seven times the amount produced from crude.

Government officials, fleet administrators, and purchasing agents often ask why they should buy re-refined lubricants when they have always purchased virgin oil manufactured from crude. Local and state governments should consider purchasing re-refined lubricant for a number of economic and environmental reasons, named below:

Re-refining, rather than burning or illegally dumping used oil, can accomplish the following:

- ☐ Reduce environmental impacts from improper disposal of used oil.
- ☐ Reduce dependence on foreign oil.
- ☐ Create American jobs.
- ☐ Provide an alternative market to burning used oil.

Misconceptions

In the earlier part of the twentieth century, methods to reclaim oil did not produce a high-quality product. This created a misconception that re-refined oil produced today is inferior to virgin-based oil. In fact, the process used to re-refine used oil is very different from methods used to reclaim oil.

The primary misconceptions about re-refined oil are:

- ☐ Nobody uses re-refined oil.
- ☐ Re-refined oil will make car engines fail.

- ☐ Re-refined oil is too expensive.
- ☐ Re-refined oil is contaminated.
- ☐ Re-refined oil will void the manufacturer's warranties.

Re-Refining Technology

Three companies in North America produce re-refined base stocks. When combined with additives, these base stocks become a range of lubricating products. Safety Kleen in Chicago, Ill.; Evergreen Holdings, Inc., in Newark, Calif.; and Mohawk in Vancouver, B.C., Canada, use the same technology to re-refine used oil. Their facilities represent a combined capacity of 5,800 barrels daily.

Reclaimed oil, in contrast, is used oil that has been filtered to remove dirt, fuel, water, and any other heavy particles. Reclaimed oil cannot pass tests to meet API standards or vehicle manufacturer requirements. On the other hand, re-refined oil is used oil that has undergone an extensive process that removes water, dirt and fuel and dissolved and suspended contaminants. The re-refined oil produced by the three re-refiners in North America does meet API standards.

Re-refined oils are also imported from Spain, Greece, Korea, and other countries. Re-refined base oils are often combined with virgin base oils in the manufacture of a lubricating product. Currently there are a number of brands of re-refined lubricating oils available in the U.S. Some of them are:

- ☐ Safety-Kleen's "America's Choice."
- ☐ Rosemead "SOAR."
- ☐ Chevron "Eco."
- ☐ 76 Products "Firebird."
- ☐ Lyondell "Enviroil."

The percentage of re-refined oil in the end product varies depending on the manufacturer and the type of lubricating oil. For example, 76 Products and Rosemead market a 15W-40 oil that contains 100 percent re-refined base stock. Safety-Kleen America's Choice 10W-30 and 10W-40 contain 70 to 100 percent re-refined base stock. Other brands contain different percentages of re-refined base stock mixed with virgin base stock. The percentage of re-refined base stock can vary depending on the type of product.

The Mohawk Re-Refining Process

The Mohawk re-refining process is the only process to date that produces lubricants that meet American Petroleum Institute standards. Three re-refining companies in the U.S. and Canada use this process. The Mohawk process employs five steps including pre-treatment, distillation of water and light hydrocarbons, distillation of diesel fuel, distillation of asphalt flux, and hydrofinishing.

The Mohawk process was designed to accept used oil from a variety of sources. The feedstock usually includes any neutral oil product such as transmission fluid, gear oil, grease, hydraulic oil, metal working oils, and motor oils. Used oil is collected from generators (service stations, motor pools, etc.) and tested for hazardous material

contamination and other parameters. It is then transported to a re-refinery where it is tested again and pumped into feed tanks.

The first step in the Mohawk process separates water and fuel contaminants from the lube component. Water typically constitutes about 10 percent of the feedstock and fuel (light hydrocarbons) makes up about 3 percent. Diesel fuel is removed in the second distillation state. The diesel, which makes up about 7 percent of the total feedstock, can be routed back into the plant as fuel or sold to industrial furnaces and boilers.

The third stage separates the heavy materials that include dirt, metals, additive components, and other contaminants. The recovered asphalt flux material is used in roofing shingles, tarpaper, and asphalt. The cleansed lube distillate (now free of water, fuel, and additives) passes through a thin-film evaporator and then to a hydrotreater.

The last stage of the Mohawk re-refining process mixes hydrogen gas and catalysts with the remaining fraction of waste oil to remove sulfur and other oxidation products. About 65 percent of the original feedstock remains at the end of the process as the finished product base oil. The base oil is split into light and medium neutral oils. These neutral oils are then ready to be combined with additives to produce products such as transmission fluid, gear oil, grease, hydraulic oil, metal working oils, and motor oils.

Lubricating Oil Standards

Re-refined lubricants must undergo testing and meet specific standards if they are to be marketed with the API certification marks, the donut and starburst symbols. API's service symbol "donut" and certification mark "starburst" identify quality engine oils for gasoline- and diesel-powered vehicles. Oils displaying one or both of these marks meet performance requirements set by U.S. and international vehicle and engine manufacturers and the lubricant industry. More than 500 companies worldwide participate in this voluntary program, which is backed by a marketplace sampling and testing program.

Re-refined oil must meet the same standards as virgin oil if the manufacturer is licensed by the American Petroleum Institute and displays the API donut symbol or the International Lubricant Standardization and Approval Committee (ILSAC) starburst symbol. Re-refined oil products are subject to the same stringent refining, compounding, and performance standards that apply to virgin oil products. All API licensed oils, whether from re-refined or crude base stocks, must pass the same tests:

- ☐ Cold start and pump ability.
- ☐ Rust and corrosion.
- ☐ Engine wear.
- ☐ High temperature thickening.
- ☐ Deposit.
- ☐ Phosphorous.

Lubricating oils can contain up to 20 percent additives to inhibit oxidation and degradation, improve viscosity, prevent foaming, and provide fire retardation. Blenders use the re-refined base stock just as they do virgin base stock—with the same additive packages—when they prepare lubrication oils to meet specifications. Some common lubricating oils in the consumer market contain re-refined oil whether or not the label identifies it.

Society of Automotive Engineers Report

The Society of Automotive Engineers (SAE) releases information on topics such as engine oil performance and engine service classification, engine oil viscosity classification and engine oil tests. In its "Surface Vehicle Information Report," revised in 1996, the SAE discusses physical and chemical properties of new and used engine oils and re-refined lubricating products.

The report discusses a range of processes used in the manufacturing of base stocks for engine oils, additive agents, physical and chemical properties, and tests pertinent to new and used oils. It is a general guide to engine oil properties and can be used as an outline for establishing oil quality inspection and maintenance programs. In this report, re-refined base stocks are described as follows:

"Re-refined base stocks may be manufactured from used oil by re-refining processes. Re-refined stocks shall be substantially free from additives and contaminants introduced from the re-refining process or from previous use. Re-refined oil can undergo one or more of the following processes: water separation, additive separation, solvent extraction, hydrotreating, and re-fractionation. The resulting finished re-refined oil is often virtually indistinguishable from good quality virgin base stocks. These re-refined oils may be suitable for use in modern engines when treated with appropriate additives."

Vehicle Manufacturer's Warranty

A little-known but critical fact about the use of re-refined oil is that it will not void a manufacturer's warranty provided the re-refined product meets the manufacturer's specifications and the vehicle is maintained at the recommended service intervals.

Federal Law

The Magnusson-Moss Warranty Act prescribes that if an after-market motor oil (whether produced from a re-refined or virgin base stock) meets the performance level specified by the engine manufacturer, the manufacturer cannot prohibit its use. The manufacturer must honor their warranty or provide a replacement product at no charge to the customer.

As a result, vehicle engine manufacturers do not prohibit the use of re-refined lubricant. They do not approve or even suggest which brands of lubricating oils to use in their engines. Instead, manufacturers specify motor oils based on API performance standards. As long as the oil is licensed by API, displays either the starburst or donut

symbol and meets the warranty requirements, the warranty must be honored. Warranty requirements are based on performance criteria, not the origin of the base oil.

Automobile Manufacturers

Chrysler, Ford, General Motors and Mercedes Benz, as well as engine manufacturers such as Detroit Diesel, have developed statements related to the use of re-refined lubricants. Mercedes Benz has conducted studies to compare re-refined motor oils to virgin-based oils using performance measures critical to engine life. These include friction reduction, wear minimization, and viscosity invariance. Mercedes Benz also puts re-refined oil in every new car manufactured in Germany. Mack Trucks has approved a number of re-refined lubricating oils for use in Mack engines.

Warranty statements, industrywide use of the API licensing system, and vehicle manufacturer evaluation of re-refined oil products have helped establish the application and performance of re-refined lubricating products. No API-certified re-refined oil product has been associated with engine failures.

Detroit Diesel Corporation:

In a letter to the Community Environmental Council, the Detroit Diesel Corporation (DDC) approved the following position on re-refined oil for use in this resource manual. This statement is supported by additional information Detroit Diesel has released related to the use of re-refined lubricants.

“Detroit Diesel, manufacturer of heavy-duty diesel and alternative fueled engines, permits the use of API-licensed re-refined oils, provided they meet SAE viscosity requirements. DDC is in favor of re-refined oils provided they are of high quality and produce a final engine oil which meets the API performance classifications and SAE viscosity grades that DDC recommends.”

Ford Motor Company:

Ford Motor Company does not specify the type of base oils to be used for engine oil meeting their requirements. Regardless of the origin of the base oils, non-Ford engine oil is acceptable for use if manufacturing and quality control practices ensure the oil continuously meets Ford's performance requirements.

Ford recommends using engine oil meeting Ford Specifications ESE-M2 153- E and licensed as certified for gasoline engines by the American Petroleum Institute (API certification). Both virgin and re-refined engine oils are capable of meeting these requirements by qualifying against a series of rigorous tests designed to ensure their suitability for modern gasoline engines. While these tests confirm that a specific sample of the oil qualifies with acceptable performance, it is the responsibility of the oil marketers to ensure that their products meet the requirements consistently and continuously.

In general, vehicle operation, adjustments, and maintenance procedures such as oil changes performed contrary to recommended manufacturer specifications may, but do not automatically, void the applicable warranty. Each warranty claim is reviewed on its own merits. If, however, the use of a non-Ford product causes or contributes to the failure of a Ford component, the cost of repairing the affected component is not covered by the Ford vehicle warranty. In such cases, the vehicle owner would have to look to the seller or installer of the non-Ford product for the replacement of the affected components and for any related damage to the vehicle.

Based on recent engine oil market surveys, Ford has concerns that some engine oils with re-refined base oils may not consistently meet Ford's engine oil requirements. Test results show viscosity characteristics and low temperature performance of some engine oils made with re-refined base oils are unacceptable. However, some older engine oils made with re-refined base oils have met API certification requirements and have met viscosity and low-temperature characteristics.

Customers considering the use of engine oils made with re-refined oils should be aware that the final product quality may vary if improper manufacturing controls are used. Marketers of engine oils made with re-refined base oils must adhere to standards for their base oils. These standards must ensure that variations in re-refining processes or incoming raw materials do not adversely affect performance. In addition to a standard for the base oil properties, Ford believes that a re-refined oil produced with stringent manufacturing controls and batch-to-batch testing of low-temperature viscosity performance and other significant characteristics would comply with Ford's recommendations.

Mercedes Benz:

In a letter to Evergreen Oil dated October 9, 1992, Mercedes Benz listed environmental protection and resource conservation as their reasons for supporting the use of re-refined oil for many years. The letter included the following statement:

"We have established that re-refined engine oil has the same performance as other engine oils. For this reason, re-refined engine oils are included in our lists of approved oils. That means from our point of view it is not important whether an engine oil consists of virgin based oil, synthetic oil or re-refined product. It has to meet our requirements. If these are fulfilled then also re-refined products can be used. However, the producer is responsible for the constancy of quality."

General Motors:

General Motors recommends for use in its vehicles engine oils that meet the performance requirements specified in the latest ILSAC Minimum Performance Standard (currently ILSAC GF1). GM also recommends oils certified by the API for use in gasoline engines. Such oils may be identified in the marketplace by looking for the certification mark shown on the lower front of the engine oil container.

Engine oils meeting these requirements can be made with either virgin or re-refined base oils. In both cases the oil marketer must take responsibility to ensure that the product satisfies the performance requirements specified above. The oil must meet these requirements during initial product approval and during the time that the product is being manufactured for sale. Marketers of engine oils made from re-refined base oils must take particular care that variations in re-refining processes or raw materials do not adversely affect oil performance.

General Motors encourages the use of properly qualified re-refined products that consistently satisfy recommended performance requirements as a means of conserving vital petroleum resources. Use of re-refined products that have not been properly qualified or do not meet performance requirements, however, could result in engine damage, and could harm the reputation of all re-refined products. Engine damage caused by the use of an engine oil that does not meet the recommended performance specifications may not be covered by the General Motors new vehicle warranty.

Chrysler Corporation:

The engine oil used in Chrysler vehicles must meet the owners manual recommendation to satisfy warranty requirements. Chrysler recommends using an oil displaying the American Petroleum Institute certification mark. The oil must contain the SAE viscosity grade appropriate to the temperature, as shown in the owner's manual.

Oils that display this registered mark on the front of the container are certified to meet all the requirements of the ILSAC GF-1 standard for engine oil. This specification does not differentiate between products made from virgin base oils or re-refined base oils. The marketer of the product must make sure that not only the initial product, but also every batch of oil, meets the requirements of this specification.

Oils made from re-refined base oils can meet these requirements; however, not all of them do. By careful control of re-refining and blending processes, some marketers produce good quality oils from re-refined base oils. These are acceptable for use under the Chrysler new vehicle limited warranty. Low or inconsistent quality oils may cause engine damage not covered by warranty.

Chrysler encourages the proper disposal and recycling of used oil to preserve natural resources and the quality of the environment. The purchase and use of these products encourages recycling.

Reduction and Recycling of Waste Automotive Fluids

If you reuse or recycle automotive fluids, you eliminate waste disposal. You may also be able to take advantage of special hazardous waste exemptions and reduce the expense and paperwork of handling waste liquids.

Appendix I—Comparisons of Antifreeze Recycling Methods

	On-Site Closed Loop	On-Site Batch	Mobile Service	Off-Site Service
Common recycling technologies	Filtration or Ion Exchange	Filtration or Distillation	Filtration or Reverse Osmosis	Distillation
Capacity (gallons per hour)	4 to 5	4 to 100	55 to 210	375 to 500
Facility worker training required	Yes	Yes	No	No
Facility disposes of recycling wastes	Yes	Yes	Some services	No
Capital cost range (1998 dollars)	\$2,500 to \$13,800	\$3,700 to \$18,000	None	None
Cost range per gallon to recycle antifreeze*	Filtration: \$3.00 to \$4.50 Ion Exchange: \$4.45 to \$7.20	\$0.74 to \$4.50	\$1.75 to \$3.00	\$3.20 to \$3.70
Average labor time required for coolant change per vehicle (minutes)	30 to 60	25 to 35	20 to 30	20 to 30
*Note: Cost ranges are after unit capital cost payback and do not include labor costs				

Appendix J—Brake Fluid Information

DOT3

DOT3 brake fluid is the "conventional" brake fluid used in most vehicles.

Advantages:

- ❑ DOT3 fluid is inexpensive, and available at most gas stations, department stores, and any auto parts stores.

Disadvantages:

- ❑ DOT3 will damage natural rubber brake seals and should not be used in any car suspected of having natural rubber seals (most Triumphs prior to 1968).
- ❑ DOT3 fluid eats paint!
- ❑ DOT3 fluid absorbs water very readily. (This is often referred to as being hygroscopic.) As such, once a container of DOT3 has been opened, it should not be stored for periods much longer than a week before use.
- ❑ Since DOT3 fluid absorbs water, any moisture absorbed by the fluid can encourage corrosion in the brake lines and cylinders.

DOT4

DOT4 brake fluid is the brake fluid suggested for use in some late model imports.

Advantages:

- ❑ DOT4 fluid is available at most auto parts stores, and at some (but not all) gas stations or department stores.
- ❑ DOT4 fluid does not absorb water as readily as DOT3 fluid.
- ❑ DOT4 fluid has a higher boiling point than DOT3 fluid, making it more suitable for high performance applications where the brake systems are expected to get hot.

Disadvantages:

- ❑ DOT4 fluid eats paint! Small leaks around the master cylinder will eventually dissolve away the paint on your bodywork in the general vicinity of the leak, and then give rust a chance to attack the body of your car.
- ❑ DOT4 fluid is generally about 50 percent more expensive than DOT3 fluid.
- ❑ Since DOT4 fluid still absorbs some water, any moisture absorbed by the fluid can encourage corrosion in the brake lines and cylinders.

DOT5

DOT5 brake fluid is also known as "silicone" brake fluid.

Advantages:

- ❑ DOT5 doesn't eat paint.
- ❑ DOT5 does not absorb water and may be useful where water absorption is a problem.
- ❑ DOT5 is compatible with all rubber formulations. (See more on this under disadvantages, below.)

Disadvantages:

- ❑ DOT5 does NOT mix with DOT3 or DOT4. Most reported problems with DOT5 are probably due to some degree of mixing with other fluid types. The best way to convert to DOT5 is to totally rebuild the hydraulic system.

- ❑ Reports of DOT5 causing premature failure of rubber brake parts were more common with early DOT5 formulations. This is thought to be due to improper addition of swelling agents and has been fixed in recent formulations.
- ❑ Since DOT5 does not absorb water, any moisture in the hydraulic system will "puddle" in one place. This can cause localized corrosion in the hydraulics.
- ❑ Careful bleeding is required to get all of the air out of the system. Small bubbles can form in the fluid that will become large bubbles over time. A series of bleeds may be necessary.
- ❑ DOT5 is slightly compressible (giving a very slightly soft pedal), and has a lower boiling point than DOT4.
- ❑ DOT5 is about twice as expensive as DOT4 fluid. It is also difficult to find, generally available only at selected auto parts stores.

DOT5.1

DOT5.1 is a relatively new brake fluid that is causing no end of confusion among mechanics. The DOT could avoid a lot of confusion by giving this new fluid a different designation. The 5.1 designation could suggest a modification of silicone-based DOT 5 brake fluid. Calling it 4.1 or 6 might have been more appropriate since it's a glycol-based fluid like the DOT 3 and 4 types, not silicone-based like DOT 5 fluid. (In fact, Spectro is marketing a similar new fluid that they are calling Supreme DOT 4, which seems less confusing.) As far as the basic behavior of 5.1 fluids, they are much like "high performance" DOT4 fluids, rather than traditional DOT5 brake fluids.

Advantages:

- ❑ DOT5.1 provides superior performance over the other brake fluids discussed here. It has a higher boiling point, either dry or wet, than DOT 3 or 4. In fact, its dry boiling point (about 275° C) is almost as high as racing fluid (about 300° C) and the wet boiling point of 5.1 (about 175 to 200° C) is naturally much higher than racing fluid (about 145° C).
- ❑ DOT5.1 is said to be compatible with all rubber formulations.

Disadvantages:

- ❑ DOT5.1 fluids (and Spectro's Supreme DOT4) are non-silicone fluids and will absorb water.
- ❑ DOT5.1 fluids, like DOT3 & DOT4 will eat paint.
- ❑ DOT 5.1 fluids are difficult to find for sale, typically at very few auto parts stores, mostly limited to "speed shops."
- ❑ DOT 5.1 will be more expensive than DOT3 or DOT4, and more difficult to find.

General Recommendations:

1. If you have a brake system that doesn't leak or show any other signs of failure, but has old seals in it, don't change fluid types as a result of reading this article. If it isn't broken, don't "fix" it—you may simply break it instead!
2. Flushing of the brake system every couple years to remove any absorbed or collected water is probably a good idea to prevent corrosion, regardless of the type of brake fluid used.
3. DOT3 is dangerous to use in Triumphs with natural rubber seals, and thus should not be used in such cars, except as a temporary "quick fix to get me home"

solution. (If this is used as a "get-me-home" solution, bleed the system as soon as possible, and be prepared to replace all your seals.)

4. DOT3 is an adequate brake fluid for use in later Triumphs, although it is rarely preferred. My recommendation would be to simply not use it.
5. DOT4 fluid, for a slight increase in cost, will give significantly increased resistance to moisture absorption, thus decreasing the likelihood of corrosion compared to DOT3.
6. DOT4 fluid has a higher boiling point than DOT3, making it preferable for high performance uses such as racing, autocross, or excessive use of the brakes in mountainous areas. For even greater braking performance, consider going to DOT5.1 or a high-performance version of DOT4 fluid.
7. DOT5 is a good choice for the weekend driver/show car. It doesn't absorb water and it doesn't eat paint. One caveat is that because it doesn't absorb water; water that gets in the system will tend to collect at low points. In this scenario, it would actually be promoting corrosion!
8. DOT5 is probably not the best fluid to use in your race car, although it is rated to stand up to the heat generated during racing conditions. The reason for this recommendation is the difficult bleeding mentioned above.
9. When changing from one fluid type to another, as a minimum, bleed all of the old fluid out of the system completely. For best results, all the seals in the system should be replaced.

Appendix K—Information About N-Hexane Use

N-Hexane-Related Peripheral Neuropathy Among Automotive Technicians—California, 1999–2000

Solvents, glues, spray paints, coatings, silicones, and other products contain normal n-Hexane, a petroleum distillate and simple aliphatic hydrocarbon. N-Hexane is an isomer of Hexane and was identified as a peripheral neurotoxin in 1964. Since then, many cases of n-Hexane-related neurotoxicity have occurred in printing plants, sandal shops, and furniture factories in Asia, Europe, and the United States.

This report describes an investigation of n-Hexane-associated peripheral neuropathy in an automotive technician, an occupation in which this condition has not been reported. The report summarizes the results of two other case investigations in the automotive repair industry. The findings suggest that solvent manufacturers should avoid using Hexane when producing automotive degreasing products, and automotive technicians should avoid regular contact with Hexane-based cleaning solvents.

In December 1998, the California Department of Health Services (CDHS) received a report from an occupational-medicine physician of a patient with peripheral neuropathy associated with occupational exposure to n-Hexane at an automotive repair facility. The index patient was a 24-year-old male automotive technician who had worked in the industry during June 1995–April 1997.

In January 1997, numbness and tingling developed in his hands and feet then spread proximally to his forearms and waist. In March, a neurological evaluation revealed bilaterally diminished reflexes of the biceps, patellar, and achilles' deep tendon. Vibration and pinprick sensations were reduced from the lower third of the forearms and downward from the waist; the result of his Romberg test was positive.

Tests evaluating his metabolic and thyroid function; urinary cadmium, arsenic, lead, and mercury levels; and central nervous system imaging were normal. However, nerve conduction velocity studies revealed a sub-acute progressive mixed motor-sensory neuropathy with distal nerve involvement. He had reported using from one to nine 15-oz. aerosol cans of brake cleaner per day during the 22 months of his employment.

This brake cleaner contained 50–60 percent Hexane (composed of 20–80 percent n-Hexane), 20–30 percent toluene, and 1–10 percent each of methyl ethyl ketone (MEK), acetone, isopropanol, methanol, and mixed xylenes. The technician sprayed the product on brakes, tools, small spills, and engine surfaces. He occasionally used a rag. He reported wearing latex gloves daily and drinking alcohol occasionally. His condition improved with cessation of n-Hexane exposure; however, he continues to have paresthesias in the hands and feet.

To assess the possible occurrence of n-Hexane-related peripheral neuropathy at other automotive repair facilities, during 1999, CDHS screened for n-Hexane-related

peripheral neuropathy at a local automotive dealership that used an aerosol product containing 1–5 percent n-Hexane and 2 percent MEK. This facility was chosen for convenience and the employees' willingness to participate. A case of n-Hexane-related peripheral neuropathy was defined as symptoms and results of nerve conduction velocity tests consistent with peripheral neuropathy in an automotive technician who had chronic occupational exposure to Hexane-containing solvents and no other explanation for peripheral neuropathy.

Screening included a medical history, an exposure questionnaire, physical and neurologic examinations, nerve conduction velocity studies, and neurophysiologic testing for cognitive and motor function, reaction time, and color vision. At the Center for Disease Control National Institute for Occupational Safety and Health (NIOSH), recent exposure to n-Hexane was estimated by measuring 2,5 Hexanedione (2,5-HD), a urinary metabolite, in acid-hydrolyzed urine samples. Air samples were not tested because management had removed the Hexane-containing solvent from the facility at the onset of the investigation.

Six of 15 technicians (40 percent) from this facility participated in the screening. All participants had worked 20 years or less as technicians; one met the case definition for n-Hexane-related peripheral neuropathy. Three of the six had detectable 2,5-HD levels, which were 7.0 percent, 26.0 percent, and 6.4 percent of the biologic exposure index (BEI) of 5 mg 2,5-HD/g creatinine. The BEI is a biomarker that correlates to the American Conference of Governmental Industrial Hygienists' eight-hour threshold limit value (ACGIH TLV) of 50 ppm. The exposure values identified are considered acceptable by this standard.

During August 2000, CDHS surveyed California neurologists* to identify additional cases of n-Hexane-related peripheral neuropathy and to determine whether exposure had occurred among persons while working in automotive repair facilities. A total of 58 of 291 neurologists (20 percent) responded to the survey. One automotive technician was identified with n-Hexane-related peripheral neuropathy. CDHS reviewed the medical records and verified that the technician met the case definition for n-Hexane-related peripheral neuropathy.

In July 2000, CDHS guidelines were published outlining the diagnosis and management of n-Hexane-related peripheral neuropathy. The guidelines and notification of the identified cases were distributed to the Association of California Neurologists and to members of the Association of Occupational and Environmental Clinics. The northern California district of the International Association of Machinists and the California Motor Car Dealer Association also were notified.

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Berkeley Division of Applied Research and Technology, National Institute for Occupational Safety and Health; and an EIS Officer, CDC.

Editorial Note:

The three cases of peripheral neuropathy described in this report are related to occupational exposure to n-Hexane among automotive technicians. Hexane-containing degreasing products are used in automotive repair facilities and usually are dispensed in an aerosol spray. Inhalation is the primary exposure route. Dermal exposure also may occur, and latex gloves provide ineffective protection from organic solvents. The neurotoxic effects of n-Hexane may be intensified when used with other chemicals found in automotive degreasers (for example, acetone, MEK, and isopropanol). Acid-hydrolyzed urinary levels of 2,5-HD, sampled at the end of a shift, correlate with workplace concentrations of n-Hexane.

Chronic n-Hexane exposure produces a gradual sensorimotor neuropathy with demyelinating features. The most common initial complaint is numbness and tingling of the toes and fingers. A progressive loss of motor function may develop. Chronic polyneuropathy with demyelinating features also is associated with other underlying conditions. Other causes of peripheral neuropathy should be considered when evaluating persons with possible n-Hexane-related peripheral neuropathy. The only known treatment for n-Hexane-related neurotoxicity is removal from n-Hexane exposure.

The prognosis for n-Hexane neuropathy generally is favorable, but recovery may take months to years, depending on disease severity. The current Occupational Safety and Health Administration permissible exposure limit (PEL) for n-Hexane, adopted in 1971, is 500 ppm in air. NIOSH established a recommended PEL of 50 ppm in 1989; the PEL for ACGIH TLV and California is 50 ppm (7).

Other cases of n-Hexane-related peripheral neuropathy may be occurring in this industry, but the nature of these exposures—and the extent of illness—is unknown. The methods used to identify the cases in this report were not intended to represent all automotive repair facilities. An exposure assessment and additional case ascertainment are in progress. Cases of n-Hexane-related neuropathy in the automotive repair industry could be prevented through reformulation of Hexane-containing products and greater use of aqueous cleaning systems.

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*List generated by Dun and Bradstreet directory (June–August 2000) Standard Industry Code sections 8011–6107.

Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.

Sources:	<p>N-Hexane is a petroleum distillate used as a solvent in vegetable oil extraction, and in cleaners, degreasers, glues, spray paints, paint thinners, coatings, silicones, and greases. These n-Hexane-containing products are often used by workers in the food processing, printing, manufacturing, painting, and automotive repair industries as well as anywhere petroleum distillates are used.</p> <p>Commercial or technical grade Hexane (the form used in most products) contains varying amounts of n-Hexane (20–80 percent) along with other related compounds, and should be treated as pure n-Hexane. Pure n-Hexane is used in laboratories. Both n-Hexane and mixed Hexanes are often referred to as "Hexane" and sometimes as "petroleum distillate" and are listed on material safety data sheets (MSDS).</p>
Pharmacokinetics:	<p>N-Hexane can enter the body via inhalation, ingestion, and dermal absorption. Inhalation of n-Hexane vapors or aerosols is the main route of occupational exposure. Dermal absorption is usually minor.</p> <p>When n-Hexane is inhaled, 10 percent is immediately eliminated unchanged through the lungs. The remaining portion is absorbed and metabolized by the liver microsomal monooxygenase system, ultimately forming the major metabolite, 2,5-Hexanedione (2,5-HD). 2,5-HD reacts with</p>

	<p>the e-amino groups of lysine in proteins, leading to the characteristic nerve damage.</p> <p>2,5-HD is excreted in the urine and is not normally stored in the body; however, if exposure to n-Hexane is prolonged or high, 2,5-HD can remain in the body and cause nerve damage. Since the urinary elimination half-life of 2,5-HD is 13 to 14 hours, 2,5-HD can accumulate in the body during the work week if n-Hexane products are used on a daily basis.</p>
Clinical Presentation:	<p>Symptoms of peripheral neuropathy develop after a few months to a year of repeated overexposure to n-Hexane. Longer nerves and thicker fibers are more susceptible to toxin-induced neuropathy; thus, the symptoms usually begin in the feet or legs. The first symptoms are sensory and consist of tingling, numbness, burning, or prickling sensations in the feet or toes. The symptoms are usually symmetric and graded distally, although symptoms may appear in one foot first or may be more pronounced in one foot. The dysesthesias spread in a centripetal, symmetrical manner if overexposure to n-Hexane continues. Ankle jerks are lost and weakness of dorsiflexion of the toes develops. Patients may have difficulty walking on their heels and may have a slapping gait. If the dysesthesias reach the upper shin, they begin to appear in the fingertips. When the dysesthesias reach the elbows and thighs, a tent-shaped area of hypesthesia may occur in the lower abdomen. With progression, this broadens with the apex extending rostrally toward the sternum. At this point, patients cannot stand, walk, or hold objects. If the neuropathy continues further, the patient may become paralyzed.</p> <p>The severity of nerve damage is related to 2,5-HD concentrations in the body and prolonged usage. The extent of nerve damage may also depend on the history of exposure to other neurotoxic chemicals. Using acetone, methyl ethyl ketone (MEK), methyl isobutyl ketone, or lead acetate in combination with n-Hexane can amplify the neurotoxic effects of n-Hexane. MEK intensifies the metabolic processing of n-Hexane, leading to a quicker, more pronounced initial motor weakness.</p> <p>Some patients have also experienced CNS complaints such as headache, dizziness, nausea, anorexia, giddiness, and/or drowsiness, and mucosal irritation with short-term overexposure. These symptoms are usually temporary and</p>

	disappear within minutes to hours after removal from exposure. Health effects on other organ systems have not been noted in human studies.
Diagnosis:	<p><i>Symptom description</i></p> <p>Begin by asking the patient to describe the symptoms and how they initially appeared. Patients with peripheral neuropathy will usually describe a neuropathy that begins in the feet and spreads in a graded, symmetrical, and centripetal fashion. Ask the patient how the disease progressed. Did the symptoms get worse over a few days or many years? Patients affected by n-Hexane will describe disease progression over several weeks to a year. Symptoms that evolve over a period of more than five years usually suggest a genetic disorder.</p> <p><i>Occupational history</i></p> <p>Description of all jobs held Work exposures Specific exposures to solvents, pesticides, and/or heavy metals (for example, methyl n-butyl ketone, carbon disulfide, acrylamide, mercury, lead, and organophosphates) Clustering of symptoms in other workers</p> <p><i>Medical history</i></p> <p>The clinical presentation of n-Hexane-associated neuropathy cannot usually be distinguished from other causes such as diabetes, renal failure, vitamin deficiency, or paraproteinemic neuropathy. Therefore, it is important to rule out these disorders. A complete medical history can aid in ruling out certain causes. Questions should be asked regarding the following:</p> <p>Viral illnesses such as polio. Medications. Occurrence of symptoms among family members. Alcohol intake. Pre-existing medical conditions or disorders such as diabetes.</p> <p>The following tests should also be considered to rule out other causes:</p> <p>Complete blood count.</p>

	<p>Erythrocyte sedimentation rate. Urinalysis. Chest x-ray. Postprandial blood glucose. Serum and urine protein electrophoresis. Vitamin B12. Creatinine. Thyroid-stimulating hormone.</p> <p>Diagnostic tests.</p> <p>The somatosensory system can be examined by tests of primary sensation. The pinprick test can be used to determine the patient's sense of pain. A wisp of cotton can be used to determine the sense of touch (avoid touching hairy skin). A flask filled with warm water at about 35–36° C and cool water at 28–32° C can be used to determine the ability to distinguish thermal sensation. A tuning fork or vibrometer can be used to determine sense of vibration. Care should be taken in interpreting these results since these subjective tests are dependent on patient response. Therefore, it is best to have the patient close or cover their eyes. Also, patients should not be pressed to undergo this examination if they are fatigued. Test results are also dependent on the limb temperature, so be certain that the ambient temperature is controlled to maintain a limb temperature of 20° F.</p> <p>Electrodiagnosis can determine the difference between axonal and demyelinating disorders, but cannot distinguish between toxic and nontoxic etiologies. Axonal degeneration usually shows a reduction in amplitude of evoked conduction action potentials with relative preservation of nerve conduction velocities. Demyelination shows a slowing of the nerve conduction velocity, dispersion of evoked compound action potentials, conduction block, and marked prolongation of distal latencies. N-Hexane neurotoxicity causes both axonal degeneration and demyelination and thus can present mixed electrodiagnostic findings. Nerve conduction tests usually show decreased motor and sensory nerve conduction velocities.</p> <p>Nerve biopsies are useful for hexacarbon neuropathies since the results are distinctive. Results show axonal swellings with secondary retracted myelin sheaths filled with massive neurofilament accumulations that are tightly pressed</p>
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	together. Some unmyelinated axons have glycogen granule accumulations in the axonal lumen. The sural nerve at the ankle is the preferred site.
Biological Monitoring:	<p>As mentioned previously, 2,5-HD, the proximate neurotoxin, is excreted in the urine and can be measured by a specialty laboratory. However, 2,5-HD leaves the body quickly, so the testing must be performed within two to three days of n-Hexane exposure. The best time for obtaining a urine sample would be at the end of the shift at the end of the workweek. Creatinine determination is important because the concentration of 2,5-HD depends on urine output.</p> <p>Previous studies determined that exposure to 50 ppm resulted in 4–5 mg/L (adjusted for specific gravity) 2,5-HD. It should be noted that almost everyone is exposed to n-Hexane and the general population has 2,5-HD urine levels of below 1 mg/L.</p>
Treatment:	The patient should be removed from further exposure. There is no other useful treatment.
Prognosis:	<p>The prognosis is usually good if the patient is removed from further exposure. The patient may experience a worsening of symptoms within the first few weeks, but improves afterward. Recovery usually takes a few months to a few years depending on disease severity. Recovery in mild to moderate cases is usually complete. Severe cases take longer to recuperate and may not recover completely, possibly experiencing residual muscle atrophy, spasticity, muscle cramps, and dyschromatopsia.</p> <p>If the patient continues to be exposed, the neuropathy worsens, ultimately developing into paralysis. Fortunately, death has not been reported in humans.</p>

What You Should Do:

- ☐ Complete a doctor's first report (DFR) of occupational illness.
- ☐ Get the MSDS of the solvent product(s) that the patient is using.
- ☐ Recommend that the patient inform their employer, if work-related, and provide documentation for medical removal.
- ☐ Contact HESIS at (510) 622-4317 if you have any questions.

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Where To Get Help

- ❑ Cal/EPA and the U.S. EPA have useful pollution prevention tool kits titled "Best Environmental Practices for Auto Repair," and "Best Environmental Practices for Fleet Maintenance." Brochures include "Switching to Water-based Cleaners for Automotive Brake Cleaning," and "Switching to Water-based Cleaners for Repair and Maintenance Parts Cleaning." The tool kits, brochures, or accompanying videos are available from the Office of Pollution Prevention and Technology Development in Cal/EPA's Department of Toxic Substances Control, (916) 322-3670. The tool kits are available online at www.epa.gov/region09/p2/autofleet.
- ❑ The South Coast Air Quality Management District maintains a list of certified aqueous cleaners at www.aqmd.gov/tao/cas/prolist.html.
- ❑ The Hazard Evaluation System and Information Service (HESIS) produces fact sheets, booklets, medical treatment guidelines, and technical documents on workplace hazards, including "Medical Guideline for Hexane." All publications are free. Some are available in Spanish or other languages. For a list of publications and order form, call (510) 622-4328; see the Web site at www.dhs.ca.gov/ohb, or write to HESIS, 1515 Clay Street, Oakland, CA 94612.
- ❑ California workers, employers, and health care professionals who have questions about the health effects of workplace chemicals can call HESIS at (510) 622-4317 and leave a message with a specific, detailed question.

- ❑ Employers who want free, non-enforcement help to evaluate the workplace and to improve the health and safety conditions can call the Cal/OSHA Consultation Service at 1-800-963-9424.
- ❑ Employees who want information or help with workplace health and safety regulations or who want to file a complaint can call the nearest district office of Cal/OSHA. Look in the government section near the front of your local phone book under "State of California, Industrial Relations, Occupational Safety and Health," or go to www.dir.ca.gov/DOSH/districtoffices.htm and find the Cal/OSHA enforcement district office nearest your workplace.
- ❑ Other resources for employees may include your supervisor, your union, your company health and safety officer, your personal doctor, or your company doctor. For information on union-related health and safety resources, contact the California Labor Federation at (415) 986-3585, or your local Central Labor Council in the "labor organizations" section of the yellow pages.

HAZARD EVALUATION SYSTEM & INFORMATION SERVICE, California
Department of Health Services, Occupational Health Branch, 1515 Clay Street, Suite 1901, Oakland, CA 94612, (510) 622-4300, www.dhs.ca.gov/ohb.

Appendix L—Scrap Tire Information

Table 1. Scrap Tire Generation: 1996

Passenger replacement ^a	175,328,000
Light truck replacement ^a	27,605,000
Medium, wide base, heavy and large off-the-road ^a	11,139,000
Farm ^a	2,460,000
Tires from scrapped vehicles ^b	49,476,000
Total Scrapped Tires	266,008,000
U.S. population	265,100,000
Rate of Scrappage	1.00 per person

^a Figures from *Tire Industry Facts 1996*, Rubber Manufacturers Association.

^b Estimates based on four tires per scrapped vehicle. Vehicle estimates for 1994 from the *Statistical Abstract of the United States*, U.S. Department of Commerce. Source: *Scrap Tire Use/Disposal Study, 1996 Update*, Scrap Tire Management Council, Washington, D.C., 1997.

Table 2. Estimated Destination for Scrap Tires in 1996

Destination	Number of Scrap Tires	% of Generation
Recycled		
Crumb rubber	12.5 million	
Cut/stamped/punched products	8.0 million	
Agricultural uses	2.5 million	
Miscellaneous uses	1.5 million	
Total Recycled	24.5 million	9%^a
Beneficially used in civil engineering	10 million	4% ^a
Combusted for energy recovery	152.5 million	57% ^a
Exported	15 million	6% ^a
Landfilled, stockpiled, or illegally dumped	64 million	24%
Total Generated	266 million	100%

^a 202 million scrap tires, or 76% of the scrap tires generated in 1996, had markets.

Adapted from *Scrap Tire Use/Disposal Study, 1996 Update*, Scrap Tire Management Council, Washington, D.C., 1997.

Appendix M—California Scrap Tire Information

Table 1.

State Contact	Legislation and Regulations	Funding Sources/Fees	Collector, Seller, and Hauler Regulations
<p><i>General</i></p> <p>California Integrated Waste Management Board (CIWMB) Waste Prevention and Market Development division Web site: www.ciwmb.ca.gov/Markets/</p> <p><i>Regulations and Permitting</i></p> <p>CIWMB Permitting and Enforcement Division Web site: www.ciwmb.ca.gov/Landfills/</p> <p><i>Tire Management</i> www.ciwmb.ca.gov/Tires/</p>	<p>SB 1322 was passed in 1989. It allows the CIWMB to promulgate regulations for State purchase of retread tires and requires the use of retreads on State vehicles (other than high-speed vehicles) after July 1, 1991.</p> <p>Under Assembly Bill 1843 (1989), the CIWMB was required to develop a permit program for waste tire facilities; set up a tire recycling program to reduce the landfilling of whole tires; and report to the legislature on the feasibility of using tires as a fuel supplement in cement kilns, lumber operations, and other industrial processes. The permit program and recycling program have been in place since 1993. The feasibility report has been completed.</p> <p>AB 1306 (Killea, Chapter 1092, Statutes of 1989)</p>	<p>Since July 1, 1990, a 25-cent-per-tire fee is collected on all tires at point of sale. The fee generates \$3 to \$4 million annually for the California Tire Recycling Management Fund. The CIWMB is administering the fund.</p>	<p>Transporters hauling more than four tires must register with CIWMB.</p>

State Contact	Legislation and Regulations	Funding Sources/Fees	Collector, Seller, and Hauler Regulations
	<p>requires that the California Department of Transportation (CalTrans), with CIWMB, review and modify all bid specifications for paving materials to encourage use of recycled materials, including scrap tires.</p> <p>Legislation regulating waste tire haulers was adopted in May 1996.</p>		

Table 2.

Storage and Processor Regulations	Disposal Restrictions	Financial/Market Incentives	Additional Methods
<p>As of July 1, 1992, new major waste tire facilities (more than 5,000 stored tires) must obtain a major waste facility permit from the CIWMB. Permit requirements include fire prevention, security and vector control measures, tire pile size and height limits, closure and pile reduction plans.</p> <p>In February 1992, the CIWMB issued requirements for obtaining a minor waste tire facility</p>	<p>Since January 1, 1993, whole tires have been banned from landfills.</p>	<p>A 5% purchase price preference is available for State-purchased products made from materials derived from used tires.</p> <p>The CIWMB has a grant and loan program to encourage the recycling of tires.</p> <p>The CIWMB has the authority to issue grants and loans to qualified companies engaged in tire</p>	<p>Stabilization and remediation of waste tire sites.</p> <p>Conferences and workshops to promote recycling.</p> <p>Collection and analysis of emissions data from facilities using TDF.</p> <p>Civil engineering investigations.</p> <p>Local fire authority training.</p> <p>Emissions testing at coal-fired cogeneration facilities.</p>

Storage and Processor Regulations	Disposal Restrictions	Financial/Market Incentives	Additional Methods
permit (less than 3,000 tires).		<p>recycling and reuse, recovery, or reduction operations, including tire shredding, crumb rubber production, pyrolysis, and the manufacture of products from scrap tires.</p> <p>The CIWMB is mandated to designate market development zones and provide economic and regulatory incentives to businesses within these zones for producing end products made with no less than 50% recycled material.</p> <p>Grants are made to Local Enforcement Agencies.</p>	Rubberized asphalt concrete technical assistance center.

For further information on scrap tire management, contact the U.S. EPA Resource Conservation and Recovery Act (RCRA)/Superfund Hotline, Monday through Friday, 9:00 a.m. to 6:00 p.m. Eastern Standard Time (EST). The national toll-free number is 1-800-424-9346. For the hearing-impaired, the number is TDD 1-800-553-7672. A document on scrap tire management, *Summary of Markets for Scrap Tires*, (Document No. EPA/530-SW-90-074B, October 1991), is available through the hotline or by writing: RCRA Information Center, U.S. EPA, Office of Solid Waste (5305W), 401 M Street S.W., Washington, D.C. 20460. The full report, *Markets for Scrap Tires* (PB92115252),

is available for \$31.50 (subject to change) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4600.

Appendix N—Handling Refrigerant

Handling CFC-12

Venting CFC-12

Section 608 of the Clean Air Act prohibits releasing CFC-12 into the atmosphere. The prohibition on venting CFC-12 has been in effect since 1992.

Section 609 Regulatory History

The original regulation promulgated under section 609 was published in July 1992. That regulation established standards for equipment that recovers and recycles CFC-12 refrigerant from motor vehicle air conditioners, rules for training and testing technicians to handle this equipment, and recordkeeping requirements for service facilities and for refrigerant retailers. A supplemental final rule established a standard for equipment that recovers but does not recycle CFC-12. The rule also established a standard for training and testing technicians to handle this equipment.

Approved Equipment

Technicians repairing or servicing CFC-12 MVACs must use either recover/recycle or recover-only equipment approved by U.S. EPA. Recovery/recycling equipment cleans the refrigerant so that oil, air, and moisture contaminants reach acceptably low levels. A list of approved recover/recycle and recover-only equipment is available from the U.S. EPA.

Technician Training and Certification

Technicians who repair or service CFC-12 motor vehicle air conditioners must be trained and certified by a U.S. EPA-approved organization. Training programs must include information on the proper use of equipment, the regulatory requirements, the importance of refrigerant recovery, and the effects of ozone depletion. Technicians must pass a test demonstrating their knowledge in these areas to be certified. A list of approved testing programs is available from the Hotline and the Web site listed previously.

Recordkeeping Requirements

Service shops must certify to U.S. EPA that they own approved CFC-12 equipment. If refrigerant is recovered and sent to a reclamation facility, the name and address of that facility must be kept on file.

Sales Restrictions

Section 609 has long prohibited the sale of small cans of ozone-depleting refrigerants to anyone other than a certified technician. The sale of **any** size container of CFC-12 to anyone other than certified technicians was prohibited under section 608 of the Clean Air Act beginning on November 14, 1994. This provision is intended to discourage "do-it-yourselfers" who recharge their own air conditioners. Such individuals often release refrigerant because they typically do not have access to

recovery/recycling equipment. The agency encourages "do-it-yourselfers" to bring their cars to certified technicians who can properly fix air conditioners using approved equipment. This avoids damage to A/C equipment by improper charging and helps to protect the environment.

Handling HFC-134a

Venting HFC-134a Refrigerant

Section 608 of the Clean Air Act prohibits releasing HFC-134a into the atmosphere. The prohibition on venting HFC-134a has been in effect since November 1995.

Section 609 Regulatory History

In March 1996, U.S. EPA proposed a rule to require recycling of HFC-134a. The rule proposed standards for recover-only and recover/recycle equipment and rules for training and testing technicians to handle this equipment. For more information about this rule, see the fact sheet "Summary of Final Rule Governing Substitutes for CFC-12 Refrigerant in Motor Vehicle Air Conditioners," available through the U.S. EPA at www.epa.gov/ozone/title6/609/subsumm.html.

Approved Equipment

Technicians who repair or service HFC-134a MVACs must recover the refrigerant and either recycle it on-site, or send it off-site to a reclamation facility so that it may be purified according to ARI Standard 700. Technicians must use U.S. EPA-approved equipment to perform the refrigerant recovery and recycling. Recover/recycle equipment cleans the refrigerant so that oil, air and moisture contaminants reach acceptably low levels. A list of approved recover/recycle and recover-only equipment is available from the U.S. EPA. Note: certain U.S. EPA-approved models can recycle both CFC-12 and HFC-134a refrigerants.

Converting CFC-12 Equipment for Use with HFC-134a

U.S. EPA regulations prohibit technicians from changing fittings on the same unit back and forth so that the unit is used for CFC-12 in the morning, HFC-134a in the afternoon, then back to CFC-12 again, etc.

U.S. EPA regulations specify that when equipment is converted for use with a new refrigerant, the converted unit must meet the applicable equipment standard set forth in the regulations. CFC-12 equipment may be permanently converted for use with HFC-134a under certain conditions. U.S. EPA intends to issue regulations placing certain restrictions on these retrofits in the future. Those restrictions may require that the manufacturer's service representative—rather than the automotive service technician—perform the retrofit, that a unit may only be retrofitted if retrofit procedures have been certified by an independent testing laboratory such as Underwriters Laboratories, and that an appropriate label is affixed to the unit. In addition, the retrofitted unit must meet the technical specifications of SAE standard J2210 and must have the capacity to purify used refrigerant to SAE standard J2099 for safe and direct return to the air conditioner following repairs.

Currently, however, in the absence of any U.S. EPA regulations, a service facility may perform such a retrofit. The equipment manufacturer's service representative may also perform the retrofit, as long as the fittings are changed in accordance with the U.S. EPA Significant New Alternative Policy (SNAP) program regulations. However, the agency cautions technicians that even though recovering a given refrigerant using permanently converted equipment is legal, it may not be technically desirable.

The equipment is designed to be compatible with specific refrigerants. Incompatible materials may cause short circuits, damage to seals, and compressor failure. Technicians should check with the recovery equipment manufacturer for recommendations about the recovery of refrigerants other than the refrigerant the equipment was originally intended to recover. Conversion of recovery equipment for use with other refrigerants may also invalidate any warranties offered by the equipment manufacturer.

Technician Training and Certification

Technicians who repair or service HFC-134a MVACs must be trained and certified by a U.S. EPA-approved organization. If a technician is already trained and certified to handle CFC-12, he does not need to be recertified to handle HFC-134a.

Recordkeeping Requirements

Service shops must certify to U.S. EPA that they own approved HFC-134a equipment. Note that this certification is a one-time requirement. If a shop purchased a piece of CFC-12 recycling equipment in the past and sent the certification to U.S. EPA, the shop does not need to send a second certification to U.S. EPA when it purchases a second piece of equipment. This is true regardless of the refrigerant the equipment is designed to handle. If refrigerant is recovered and sent to a reclamation facility, the shop must retain the name and address of that reclaimer.

Sales Restrictions

There is no restriction on the sale of HFC-134a, so anyone may purchase it. The U.S. EPA will issue a proposed rule that will include a proposal to restrict the sale of HFC-134a so that only technicians certified under sections 608 and 609 may purchase it.

Handling Other Refrigerants That Substitute for CFC-12

Venting Substitute Refrigerants

Other than HFC-134a, all U.S. EPA-accepted refrigerants that substitute for CFC-12 in motor vehicles—and that are currently on the market—are blends that contain ozone-depleting HCFCs such as R-22, R-142b and R-124. (See www.epa.gov/ozone/hcfc.) Section 608 of the Clean Air Act prohibits venting any of these new blend substitutes into the atmosphere. The prohibition on venting these ozone-depleting blends has been in effect since 1992.

Section 609 Regulatory History

The December, 1997, final rule established a standard for equipment that is designed to recover, but not recycle, any single, specific blend substitute refrigerant.

Using Older Equipment to Recover Blends

Technicians have a number of choices in recovering blend refrigerants. A technician may permanently dedicate an older piece of equipment he owns to recovering one or more blend refrigerants. The technician may also use this equipment to recover contaminated CFC-12 and HFC-134a and other "mystery mixtures." This equipment, however, may no longer be used to recover uncontaminated CFC-12 or HFC-134a. Refrigerant recovered using this kind of "junk" tank must then be shipped off-site for reclamation or destruction.

Using New Equipment to Recover Blends

Another option for recovering a blend refrigerant is to use a new piece of U.S. EPA-approved equipment designed to recover—but not recycle—any single, specific blend refrigerant. The U.S. EPA regulation published in December 1997, includes an appendix that describes the standards that this new equipment must meet.

In addition, U.S. EPA is currently working with independent testing laboratories and equipment manufacturers to devise a standard for new equipment that can recover, but not recycle, both multiple blend refrigerants and contaminated CFC-12 and HFC-134a.

Recycling Blends

As of June 1, 1998, U.S. EPA allows recycling of refrigerant blends used in motor vehicle air conditioning systems (MVAC), provided that a) recycling equipment meets a new Underwriters Laboratories (UL) standard (Standard 2964) and b) refrigerant is returned to the vehicle from which it was removed. The only exception to item b) is for fleets of vehicles with a common owner; recycled blend refrigerant may be moved among vehicles within such a fleet. U.S. EPA plans to adopt this new UL standard into its regulations. U. S. EPA will grandfather any equipment that (1) meets the UL standard and (2) is purchased before the date on which U.S. EPA publishes a proposed rule to adopt the UL standard.

Converting CFC-12 or HFC-134a Recover/Recycle Equipment for Use With Blend Substitutes

U.S. EPA currently prohibits the conversion of existing CFC-12 or HFC-134a recycling equipment for either temporary or permanent use with a blend refrigerant. Such conversion is allowed when the equipment is used only to recover, but not to recycle, the refrigerant. In the future, U.S. EPA may issue regulations allowing these conversions but placing certain restrictions on who performs the conversions, what models may be converted, etc.

Technician Training and Certification

Technicians who repair or service MVACs that use blend refrigerants must be trained and certified by a U.S. EPA-approved organization. If a technician is already trained and certified to handle CFC-12 or HFC-134a, he does not need to be recertified to handle a blend refrigerant.

Recordkeeping Requirements

Service facilities that work on vehicles that use blend substitutes must certify to U.S. EPA that they own approved equipment designed to service these refrigerants. Note that this certification is a one-time requirement. If a shop purchased a piece of CFC-12 or HFC-134a recycling equipment in the past, and sent the certification to U.S. EPA, the shop does not need to send a second certification to U.S. EPA when it purchases a second piece of equipment. This rule applies regardless of the refrigerant the equipment is designed to handle. If refrigerant is recovered and sent to a reclamation facility, the shop must retain the name and address of that reclaimer.

Sales Restrictions

Section 608 regulations prohibit the sale of any size container of any blend refrigerant to anyone other than a certified technician. This prohibition began in November 1994.

Retrofitting Vehicles to Alternative Refrigerants

Section 609 of the Clean Air Act does not govern retrofitting. Section 612 describes the U.S. EPA Significant New Alternatives Policy (SNAP) program. This section requires that when retrofitting a CFC-12 vehicle for use with another refrigerant, the technician must first extract the CFC-12, cover the CFC-12 label with a label that indicates the new refrigerant in the system and other information, and affix new fittings unique to that refrigerant. In addition, if a technician is retrofitting a vehicle to a refrigerant that contains R-22, the technician must ensure that only barrier hoses are used in the A/C system. Finally, if the system includes a pressure relief device, the technician must install a high-pressure compressor shutoff switch to prevent the compressor from increasing pressure until the refrigerant is vented.

Much more information about the SNAP program and about retrofitting procedures is available in a fact sheet called, "Choosing and Using Alternative Refrigerants," through the U.S. EPA which is available online at www.epa.gov/ozone/title6/609.

Recovering Refrigerant During Motor Vehicle Air Conditioner Disposal

A rule effective January 29, 1998, contains provisions designed to clarify that automotive service technicians and motor vehicle disposal facility operators may, under certain conditions, recycle and resell refrigerant after it has been recovered from a motor vehicle destined for disposal.

For more information, see the fact sheet "Recovering Refrigerant at Salvage Yards and Other Motor Vehicle Disposal Facilities" through the U.S. EPA which is available online at www.epa.gov/ozone/title6/609/disposal/salvage.html.

Five Steps to Insure Compliance Regarding Refrigerants for Motor Vehicle Salvage Facilities

Step 1: Obtain Technician Certification, if Applicable

Persons who recover refrigerant from MVACS prior to their disposal must obtain technician certification through a U.S. EPA-approved program if the refrigerant will be charged into an MVAC or MVAC-like appliance. Alternatively, an employee, owner, operator of, or contractor to the disposal facility may conduct the recovery. Remember, a certified technician must perform the actual recharging into an MVAC or MVAC-like appliance. If the refrigerant is sent to be reclaimed, a certified technician does not need to do the recovery.

Note: If your facility recycles appliances such as refrigerators, freezers, and room air conditioners, a different type of technician certification is required.

Step 2: Obtain Refrigerant Recovery Equipment

Refrigerant must be removed from MVACs by using recovery equipment that is able to reduce the system pressure to 102 mm mercury vacuum. Refrigerants must be recovered using equipment designed to handle a specific refrigerant.

If the refrigerant will be charged into an MVAC or MVAC-like appliance without prior reclamation, then the refrigerant must be recovered and recycled using approved equipment dedicated for use with MVACs and MVAC-like appliances.

Step 3: Register Your Refrigerant Recovery Equipment

Owners of recovery equipment are required to register their equipment by completing the U.S. EPA form "Refrigerant Recovery or Recycling Device Acquisition Certification Form" through the U.S. EPA which is available online at www.epa.gov/spdpublic/title6/608/recoveryform.pdf and sending it to the U.S. EPA's regional office in Chicago. The address is located on the back of the form. Sending this certification form by certified mail is recommended to ensure the U.S. EPA receives it.

Step 4: Manage Your Recovered Refrigerant Correctly

Salvagers should try to recover refrigerants as soon as possible after vehicles arrive at their facilities. When recovering refrigerants, make sure different types of refrigerants are not mixed. Recover each type of refrigerant into its own container. Refrigerant reclaimers and wholesalers will pay for used refrigerant that is not mixed, but they charge for taking mixed refrigerants. Used refrigerants must be recovered into federal Department of Transportation-approved cylinders.

Refrigerant recovered by MVAC disposers can either be sent to a U.S. EPA-certified reclaimer or be recycled. The recycling has to be done by an MVAC-certified technician or by an employee, owner, or contractor to the disposal facility using approved recycling equipment. It must be used in an MVAC or MVAC-like appliance. The actual recharging of refrigerant into an MVAC or MVAC-like appliance has to be done by an MVAC-certified technician.

Step 5: Keep Accurate Up-To-Date Records

Anyone who recovers refrigerant from MVACs or MVAC-like appliances for purposes of disposal must certify to U.S. EPA that they have acquired equipment that meets the requirements.

Keep copies of the technician certifications at the place of business or work site, if located separately.

Keep copies of the "Verification of Refrigerant Removal" form at the place of business or work site, if located separately, for at least three years. When MVACs arrive at your facility with the refrigerant already removed, the MVAC supplier must fill out the "Verification of Refrigerant Removal." This form may act as a contract (for example, between an individual and a salvage yard or between a salvage yard and a scrap metal facility) to document that the refrigerant has been removed from the MVAC prior to delivery.

Anyone who sells or distributes ozone-depleting refrigerant must retain invoices that indicate the name of the purchaser, the date of sale, and quantity of refrigerant purchased.

Keep records of the waste removed from each vehicle. The form "Motor Vehicle Dismantling Waste Removal Checklist" has been developed to help you establish a set procedure for recovering motor vehicle wastes and to keep records of the wastes removed from each vehicle. Keep this form in conjunction with the "Verification of Refrigerant Removal."

Appendix O—Environmental Regulations History Overview

Factors that Influenced Law-Making and Regulation Writing:

- Industrial accidents.
- Occupational safety.
- Consumer protection.
- Environmental protection movement.

Industrial Accidents

Industrial development has always included accidents. These include explosions, seepage of toxins into soil or water, and atmospheric releases. One of the worst industrial explosions that occurred in America was on April 16, 1947, when an explosion of a freighter being loaded with nitrate occurred. The resulting three-day fire caused 752 deaths, injured another 3,000 people and destroyed much of the infrastructure and housing in Texas City, Texas. The more recent shipping related accidents have involved the release of harmful chemicals, especially crude oil. These accidents have caused severe environmental and economic impact.

Two oil accidents since 1978, in particular, have resulted in more environmental regulations. The *Amoco Cadiz*, which was owned by the U.S. Company Standard Oil, ran aground while off the Brittany coast of France on March 16, 1978. The ship's steering gear was damaged by the heavy waves of storm-force gales. There was a 90-minute delay in attempting to tow the ship, due to a disagreement between the captain of the *Cadiz* and the captain of the tugboat *Pacific*. The French government employed approximately 8,000 people to clean the entire coastline and Standard Oil paid \$16.7 million to the French for restitution.

More than 2,200 seabirds were killed in the *Amoco* accident. The oyster industry suffered for months, but the coast suffered less damage than originally anticipated because of the sea's natural cleansing action. As a result of this accident, supertankers now have to have exceptionally strong steering gear. The primary lesson learned from this disaster was that the captain of the tanker must be the sole judge of danger to his ship and must act accordingly in order to prevent delay of proper action.

On March 24, 1989, the Exxon Valdez hit submerged rocks on a reef in Prince William Sound off the southern coast of Alaska, releasing 11 million gallons of crude oil. The captain was drunk on duty and had retired to his cabin, leaving an inexperienced crew member to guide the ship through the Sound.

The environmental devastation included the death of 34,000 shore birds, 1,000 sea otters and uncounted numbers of fish, which jeopardized the area's \$100 million-per-year fishing industry. The total cost of the spill and cleanup attempts was \$1.5 billion.

Prior to construction of the Trans-Alaska Pipeline System, many environmentalists raised issues concerning the possibility of an oil spill in the Sound. Officials of Alyeska, the oil consortium formed to pump oil from Alaska's north slope to the terminus in Valdez, insisted that a spill would be "unlikely." They assured congress that they would have trained people on a spill site within five hours. However, the company disbanded its full-time highly trained cleanup crew during the mid 1980s and replaced it with a part-time inexperienced one. This crew arrived at the spill site more than 14 hours later.

In response to this accident, Congress passed the Oil Pollution Act of 1990. This revised section 311 of the Clean Water Act to prevent future oil and hazardous substance discharges; tighten ship, personnel, and equipment requirements; create a \$1 billion cleanup fund; strengthen federal oil removal authority; and increase civil and criminal penalties for the spilling of oil into the sea.

Occupational Safety

Occupational safety and consumer protection have always been interrelated. In late 19th century Chicago, meat packinghouse operators allowed unjust labor practices and workers endured squalid and dangerous working conditions. These conditions also negatively impacted the way the meat products were prepared and packaged.

The history of occupational health and safety has a long history throughout the industrialization of Western civilization. Bernardino Ramazzini, an Italian medical professor from 1682–1714, compiled information concerning potters, glassmakers, and hat makers that were exposed to lead, borax, and mercury respectively. The potters suffered from trembling, paralysis, and loss of teeth from the lead. Glass makers had ulcerated lungs and sores in their mouths from the borax and antimony used to color glass, and hat makers suffered from mercury poisoning. By 1910, Alice Hamilton, the first occupational disease specialist, realized that the only information available about the health effects of new chemicals depended on "use of the workers as guinea pigs."

Underground mining was an extremely hazardous occupation in the United States before the passage of numerous laws to protect mining employees. Prior to the creation of the Bureau of Mines in 1910, no reliable statistics on mining injuries or deaths were available. But thousands had been killed by explosions, most often in large groups. Since then, the number of fatalities in the U.S. related to coal and metal/non-metal mining has declined steadily. This is a result of the numerous mining safety laws passed by congress between 1910 and 1977.

The Bureau of Mines, due to Public Law 61-89, provided for investigations of accidents and research in areas of mineral extraction, accident prevention, and first aid and rescue. P.L. 77-49 in 1941 allowed for safety inspections by federal inspectors and provided right of entry. The Coal Mine Safety Act in 1952 applied to coal mines with more than 15 employees. In 1963, the law was extended to small mines. The Federal Metal and Nonmetallic Mine Safety Act of 1966 established

annual inspections. The Federal Coal Mine Health and Safety Act of 1969 mandated annual inspections, civil penalties for violations, and criminal penalties for knowing and willful violations. It was amended in 1977, to include coal, metal, and nonmetal mines under a single law. This law mandated training for miners.

Prior to 1970, no uniform laws existed to protect non-mining workers from safety hazards on the job. The statistics that the United States Congress evaluated at that time included more than 14,000 deaths due to job related accidents and almost 25 million workers disabled. This was more than 10 times the number of man hours lost due to job related accidents as compared to strikes. The estimated new cases of occupational disease were totaling 300,000.

Congress passed the Occupational Safety and Health Act (OSHA) in 1970 and the President signed it into law. This law authorizes the government to write regulations for work-related health and safety. By 1990, more than 6 million workplaces and their 90 million employees were covered by the act. Even today, workers in the United States as well as abroad may be exposed to harmful chemicals. Of primary concern are chronic exposures to solvents in factories, polychlorinated biphenyls (PCB) in transformers, and organochloride pesticides in agriculture. However, every industry and business sector employee has at least a few harmful chemicals that they may be exposed to in the workplace.

Consumer Protection

In the United States efforts to regulate the quality of food and drugs began shortly after settlement of North America by Europeans. Many colonies passed food laws regulating weight of loaves of bread. They also enacted several food inspection laws to establish standard weights and measures, including sizes of barrels used to ship flour, fish, and meat. The Import Drugs Act of 1848 was the earliest federal law to regulate products for human consumption. Contaminated quinine from Mexico, given to U.S. troops for the treatment of Malaria, caused a number of deaths. In 1899, the National Consumers League was formed to promote consumer interests.

From 1902–07, the U.S. Department of Agriculture Bureau of Chemistry used a group of volunteers called the “Poison Squad,” who agreed to eat a variety of foods containing carefully controlled amounts of preservatives. The purpose was to test the safety of the preservatives. At the conclusion of these experiments the public consensus was that preservatives should be used with caution, if at all. In response to public concern, the federal government enacted the Pure Food and Drug Act of 1906, established the Federal Trade Commission in 1916, and the Food and Drug Administration in 1931. Prior to 1906, none of the 190 bills introduced between 1879 and 1906 that dealt with adulteration and mishandling of food and drugs were passed.

Environmental Protection Movement

While many people consider the 1962 publication of “Silent Spring,” by Rachel Carson, to be the beginning of the environmental protection movement in Western Civilization, awareness of environmental issues goes back at least 200 years. Examples include an ordinance established by the French in 1769 to protect the

forests on the island of Mauritius in the Indian Ocean. The ordinance prescribed that at least 25 percent of a landowner's forest had to be preserved, especially forests on steep slopes. All deforested forests were to be replanted, and forests within 200 yards of waterways were to be protected. Generally speaking, the development of environmental awareness can be chronologically subdivided into six categories.

1. *Preconservation Period* (1500s–1900). This period occurred during the European settlement of America. It was one of exploration, acquisition, and exploitation. It resulted in enormous waste of natural resources with minimal regard for the future needs of the American people. As result, the United States currently imports most of the energy and raw material needs from other countries.
2. *Early Conservation Warnings* (1832–70). Horace Greeley, Ralph Waldo Emerson, Henry David Thoreau, and others expressed concerns about disappearing natural resources and warned the public about the dangers of wastefulness. Generally, their contemporaries ignored these people, since public opinion was that the country's natural resources would last forever.
3. *Beginning of Federal Role* (1870–1916). The establishment of Yellowstone National Park in 1872 initiated this time period. In 1890, the Census Bureau declared the United States had been settled to the point that its geographic frontier was closed, which led to the Forest Reserve Act in 1891. This law set aside the Yellowstone Timberland Reserve as the first federal reserve, and also authorized the president to set aside additional acreage and to protect water resources. In 1892, John Muir founded the Sierra Club and served as its first president. Muir believed that man is a member of nature and should be a protector of nature rather than a conqueror. Aldo Leopold later led the Sierra Club. He developed the "Land Ethic," which was later set forth in his book, *A Sand County Almanac*. As preservationists, both men thought that large tracts of public lands should be protected from exploitation and set aside for future generations. Scientific conservationists, whose view was that federal lands were resources to be developed for the public good, established an opposing point of view at the time. The government was to protect the land from short-term destructive development, but the lands were to be managed scientifically for sustainable yield.

Both the preservationists and conservationists agreed that federal lands should be managed for widespread and fair use and President Theodore Roosevelt, one of the early conservationists, convinced Congress to grant him executive powers for establishment of wildlife refuges between 1901 and 1909. In 1903, the first federal refuge was established at Pelican Island, off the coast of Florida. Additionally, President Roosevelt tripled the size of the forest reserves. In 1905, the Audubon Society was founded and the U.S. Forest Service was created with Gifford Pinchot appointed as the first director. He pioneered the first studies of sustained yield and multiple uses of forests. Congress, angered by Roosevelt's additions to the forest reserves, in 1907 amended the Forest Reserve Act of 1891 to ban further additions. They also changed the name of the forest reserves to national forests, with the

implication that forests should not be withdrawn from all uses. In defiance of Congress, Roosevelt—on the day before the amendment became law—added an additional 16 million acres to the national forests.

In 1913, during the controversy surrounding the construction of the Hetch Hetchy Dam and Reservoir in what is now Yosemite National Park, a split occurred in the conservation movement between the preservationists and the scientific conservationists. The controversy was highly publicized and continues today. In 1912, Congress created the National Park System and passed the National Park System Organic Act in 1916. This law established national parks to preserve scenery and wildlife while leaving the parks unimpaired for future generations. This act also established the National Park Service.

Until the early 1930s, the government made few continuing efforts in conservation. From 1921 through 1933, republican administrations increased use of public lands to favor big business and promote economic growth. President Herbert Hoover attempted to return all federal lands to the states or sell them to private interests at ridiculously low prices. Due to the economic depression, sales were nonexistent.

4. *Expanding Federal Role* (1933–60) activities began with President Franklin Delano Roosevelt forming the Civilian Conservation Corps (CCC) to provide jobs for 2 million unemployed young men. The CCC built trails in parks and installed stream bank erosion control structures. The agency also attempted to repair damage from land misuse. The federal government built many large dams and water projects to provide jobs, cheap irrigation water, flood control, and electricity.

In 1933, the Soil Erosion Service was formed to address the catastrophic erosion problems of the Great Plains states. It was subsequently renamed the Soil Conservation Service in 1935 and then again in 1994 as the Natural Resources Conservation Service.

In 1934 Congress passed the Taylor Grazing Act, which required permits and fees for grazing on public lands. The law also placed limits on the numbers of animals that can be grazed. Since that time ranching interests have attempted to remove grazing lands from public ownership so private companies can retain ownership of the lands.

President Ronald Reagan's administration encouraged this trend, known in the 1980s as the "Sagebrush Rebellion." The Grazing Service had been renamed the Bureau of Land Management in 1946. Until the Federal Land Policy and Management Act of 1976, western Congressional delegates had kept the BLM under-funded, understaffed, and without enforcement powers. The controversy continues today.

The 1937 Federal Aid Wildlife Restoration Act levied an excise tax on guns and ammunition. This act raised more than \$2.1 billion for states to buy land for wildlife

conservation, conduct wildlife research, and reintroduce wildlife in areas where the populations have declined.

Between 1940 and 1960, World War II and the resulting economic recovery resulted in very little federal conservation activity. Congress enacted the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) in 1947. It was eventually amended in 1972 to address environmental and worker safety problems with biocides. In 1948, the first major recorded air pollution disaster in the United States occurred in Donora, Pennsylvania. Pollutants from the town's steel mill, zinc smelter, and sulfuric acid plant stagnated over the town of 14,000, causing illness in 6,000 and 20 deaths. This led in part to the passage of the Air Quality Act of 1967. In 1951, preservationists stopped the Bureau of Reclamation of the Department of the Interior from building a dam in Dinosaur National Park. The park covers parts of both Colorado and Utah. But more than half of the wetlands lost since the beginning of European settlement were destroyed between 1950 and 1970.

5. *Rise of the Modern Environmental Movement (1960–80)*. The modern environmental movement began under President John F. Kennedy and expanded under Lyndon B. Johnson. In 1962, the publication of *Silent Spring*, by biologist Rachel Carson, brought public attention to the problems resulting from the pollution of air, water, wildlife, and ecosystems due to slowly degradable pesticides such as DDT. The importance of air, water, and soil quality was a new idea for the general public. The response to *Silent Spring* marks the beginning of the current environmental movement. In 1964, the Wilderness Act authorized the government to place undeveloped tracts of land into the National Wilderness System. This act allows Congress and future generations to make land-use decisions at a later time about resource development for the national good.

The emerging science of ecology received widespread media coverage between 1960 and 1970. Incidents such as the following raised public awareness about the environment : high concentrations of air pollutants accumulated over New York City, killing 300 people in 1963; and during the mid-1960s, foam from non-biodegradable detergents began appearing in streams and rivers. By the late 1960s, Lake Erie became so polluted that large numbers of fish died, the game fish population was decimated, and beaches closed. The Cuyahoga River in Cleveland, Ohio, caught fire and burned down two bridges in 1969. By the mid-1970s the bald eagle, the California condor, and the whooping crane were near extinction because of pollution and habitat destruction.

April 22, 1970, was the first celebration of Earth Day in the United States. More than 20 million people rallied, demanding better environmental quality. Elected officials responded: Congress passed more than 20 separate environmental legislative orders related to clean air and water between 1969 and 1980. A key legislative action was the National Environmental Protection Act of 1970. This law created the Council of Environmental Quality, required environmental impact statements, and provided environmental considerations for all federal actions. The U.S.

Environmental Protection Agency (U.S. EPA) was created by an executive order of President Nixon in 1970.

The Resource Conservation and Recovery Act (RCRA) was enacted in 1976. It requires a regulatory system to monitor and license the generation, treatment, storage, transport, and disposal of hazardous wastes. It was amended in 1978, 1980, and then again in 1984. The amendment in 1984 was called the Hazards and Solid Waste Amendments Act. RCRA is a broad reaching system with severe penalties to ensure compliance with its provisions. The Toxic Substances Control Act, enacted in 1976, provided authority for the federal government to regulate the manufacture, distribution, and use of chemical substances. The law can require the testing of potentially harmful chemicals by the manufacturers. However, many synthetic chemicals are still currently untested.

In 1977, Congress enacted and President Jimmy Carter signed the Endangered Species Act (ESA) and the Clean Water Act. The ESA provides a mechanism for the Department of the Interior to preserve plants and animals that are in danger of extinction, as well as to conserve the ecosystems on which they depend. To accomplish this, the U.S. Fish and Wildlife Service administers the law in cooperation with states. The Clean Water Act requires national standards for water quality and establishes a permit system known as the National Pollution Discharge Elimination System for the disposal of pollutants into streams and lakes. Subsequent amendments to the act in 1987 bolstered the requirements for the water quality-based standards. Section 404 of this act regulates the dredging and dumping of spoil materials into wetlands, and the U.S. Army Corps of Engineers issues permits based on guidelines developed in conjunction with the U.S. EPA. In December of 1980, President Jimmy Carter signed into law the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This act created the SuperFund and provides for the cleanup of past hazardous waste dumps. The law is complex, and controversy continues today due to the nature of regulations issued by U.S. EPA as a result of CERCLA. In the center of the controversy is the determination of the potentially responsible parties who will pay for the site's cleanup. Extensive litigation and criticism of U.S. EPA is common. The combination of RCRA and CERCLA has been described as a "cradle to grave" regulatory and cleanup program for hazardous wastes.

One of the most notorious cases of hazardous waste abuse occurred in the Niagara Falls area of New York. The Love Canal was an inactive canal excavation used as a dumpsite for 22,000 tons of hazardous and carcinogenic waste by Hooker Chemical Company in the 1940s. The company covered the site and later sold it to the local school board for \$1 and a release of any liability associated with the site. It was eventually used for an elementary school and 250 homes. There was an extremely high incidence of birth defects, cancer, and other major health problems for the community residents. After years of protest from the local citizens, the federal government declared the site a disaster and evacuated the area. Many of the homes and the school were torn down. Cleanup costs exceeded \$140 million, and

lawsuits from this incident continued well into the 1990s. Eventually Occidental Petroleum—which had purchased Hooker Chemical—lost a lawsuit in 1994, in which the company was held liable for the cleanup costs under CERCLA.

President Carter tripled the amount of land in the National Wilderness System as a final act just before leaving office in 1981, by using the Antiquities Act of 1906. He added tremendous expanses of public land in Alaska. He also doubled the area under the National Park Service's administration.

During the 1980s, the Regan administration attempted to reverse the environmental trends of the previous administrations. This administration slashed the budgets of the federal agencies responsible for enforcement of existing environmental and resource laws. The federal budget for research into energy conservation was cut by more than 70 percent, while the nuclear power industry was given more than \$40 billion in subsidies. Additionally, President Reagan appointed people from industry to key positions in the Department of the Interior and the U.S. EPA.

6. *1990s and Beyond.* With the passage of the Pollution Prevention Act in 1990, Congress declared that America's first environmental priority was to prevent or reduce pollution at the "source," whenever and wherever possible. The new focus of the U.S. EPA follows five objectives in hierarchical order. These include prevention, recycling, treatment, waste minimization, and disposal. In short, the idea of pollution prevention, otherwise known as P2, is to avoid creating the waste. A focus on consumer values should lead to new policies to "reduce, reuse, recycle," as well as energy conservation, reduction of packaging, and an ethic based on "less is better."

Appendix P—How to Create an Oil Life Extension Program at Your Facility

Below are four aspects of a successful, cost-saving oil life extension program:

1. Establishing baseline information.
2. Conducting engine oil sampling.
3. Testing oil.
4. Evaluating test results.

Establishing Baseline Information

Baseline data for each of your vehicles provides information that will help you evaluate test results and make decisions about extending oil life. Document the following:

- ☐ Oil change intervals.
- ☐ Operating environment.
- ☐ Recent maintenance or repair work.
- ☐ Brand and type of oil used.
- ☐ Vehicle age.

Conducting Engine Oil Sampling

Engine oil sampling should be performed at regular intervals. Begin your program by sending samples to an off-site laboratory for testing.

Consider this: Collecting engine oil samples does not require much extra labor, particularly if samples are collected during scheduled preventive maintenance and safety checks. Sampling labor is usually offset by reductions in oil change labor.

Sampling tips:

- ☐ Run the engine, then sample soon after turning the engine off.
- ☐ Collect a sample by:
 - ☐ Installing a valve to draw off oil just before the filter.
 - ☐ Withdrawing oil through a narrow hose inserted in the dipstick tube.
 - ☐ Taking a sample when the oil is changed (within 15 minutes of engine shutoff).
- ☐ Keep hands out of sample bottles and keep bottles tightly capped before and after sampling to minimize foreign contamination.
- ☐ Consult oil-testing companies for sampling equipment and methods.

Metal Contamination and Its Sources

Aluminum:

- ☐ Piston or bearing wear.
- ☐ Hydraulic system pumps.
- ☐ Transmission components.

Chromium:

- ☐ Piston rings.
- ☐ Roller bearings in geared compartments.
- ☐ Valve stem wear.

Copper:

- ☐ Thrust bearing wear.
- ☐ Oil cooler core “leaching.”
- ☐ Transmission or steering disc wear.

Iron:

- ☐ Gear, shaft, or liner wear.

Testing Oil

The following are sources of engine oil contaminants:

- ☐ Antifreeze contaminates engine oil through a coolant leak, causing bearing damage and piston, ring, and liner wear. The first sign of a coolant leak is detection of sodium, potassium, or boron in the oil.
- ☐ Metals from engine wear contaminate engine oil.
- ☐ Fuel contaminates engine oil as a result of faulty injectors and can reduce oil-lubricating qualities, lower oil viscosity, and lead to bearing failure. As little as 1 percent fuel content decreases oil viscosity by 4 to 6 percent.
- ☐ Sand and dirt (silicas) enter engine oil from outside sources and cause abrasive wear of engine parts.
- ☐ Water contamination of engine oil is usually caused by condensation in the crankcase. Large amounts of water contribute to formation of metal-corroding acids that can damage pistons, rings, and the liner. Oil performance is affected when its water content exceeds 0.3 percent.

Selecting test methods:

Most fleet maintenance facilities test engine oil for a variety of contaminants and therefore use more than one testing method. Common tests for oil life extension include testing for water, metals, viscosity, antifreeze, and dielectric constant.

Evaluating Test Results

On-site testing:

After you see how you can extend oil life based on the test results, consider purchasing on-site oil analysis equipment to lower your program costs and significantly reduce your waiting time for results.

On-site testing reduces the lag time between sampling and decision-making because test results are obtained almost immediately. On-site testing equipment ranges from small, handheld units that simply measure dielectric constant, to more complex analyzers that can identify specific contaminants and produce oil quality reports. Hickam Air Force Base in Hawaii used both a LubriSensor and a Computational Systems Inc. (CSI) Model 5100 oil analyzer to conduct their oil analysis program.

They found that both provided comparable results to off-site laboratory analysis. The Lubri-Sensor costs about \$600 and the CSI 5100 costs about \$8,000.

Vendor Contact Information

LubriSensor (for measuring dielectric constant on-site):

Northern Technologies Int'l Corp.

1-800-328-2433

CSI 5100 (for on-site oil analysis)

CSI: (423) 675-2110

For off-site oil analysis for various parameters:

Herguth Laboratories, Inc.

1-800-645-5227

For off-site oil sampling and Probilizer sampling ports

Titan Laboratories

1-800-848-4826

Web sites

National Oil Recyclers Association: www.noraoil.com

Appendix Q—U.S. EPA Waste Codes: F List

Code	Description
F001	The following spent halogenated solvents used in degreasing: Tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of 10% or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.
F002	The following spent halogenated solvents: Tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, trichlorofluoromethane, and 1,1,2-trichloroethane; all spent solvent mixtures/blends containing, before use, a total of 10% or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F001, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.
F003	The following spent non-halogenated solvents: Xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents; and all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, and a total of 10% or more (by volume) of one or more of those solvents listed in F001, F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent mixtures.
F004	The following spent non-halogenated solvents: cresols, cresylic acid, and nitrobenzene; all spent solvent mixtures/blends containing, before use, a total of 10% or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, and F005; and still bottom from the recovery of these spent solvents and spent solvent mixtures.
F005	The following spent non-halogenated solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of 10% or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002 or F004; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

Code	Description
F006	Wastewater treatment sludges from electroplating operations except from the following processes: (1) sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc, and aluminum plating on carbon steel; and (6) chemical etching and milling aluminum.
F007	Spent cyanide plating bath solutions from electroplating operations.
F008	Plating bath residues from the bottom of plating baths from electroplating operations in which cyanides are used.
F009	Spent stripping and cleaning bath solutions from electroplating operations in which cyanides are used.
F010	Quenching bath residues from oil baths from metal heat-treating operations in which cyanides are used.
F011	Spent cyanide solutions from salt bath pot cleaning from metal heat-treating operations.
F012	Quenching wastewater treatment sludges from metal heat-treating operations in which cyanides are used.
F019	Wastewater treatment sludges from the chemical conversion coating of aluminum except from zirconium phosphating in aluminum-can washing when such phosphating is an exclusive conversion coating process.
F020	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) or tri- or tetrachlorophenol or of intermediates used to produce their pesticide derivatives. (This listing does not include wastes from the production of hexachlorophene from highly purified 2,4,5-trichlorophenol.)
F021	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of pentachlorophenol, or of intermediates used to produce derivatives.
F022	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra- or penta- or hexachlorobenzenes under alkaline conditions.
F023	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the production or manufacturing use (as a reactant, chemical intermediate, or component in formulating process) or tri- and

Code	Description
	tetrachlorophenols. (This listing does not include wastes from equipment used only for the production or use of hexachlorophene from highly purified 2,4,5-trichlorophenol).
F024	Process wastes including, but not limited to, distillation residues, heavy ends, tars, and reactor clean-out wastes, from the production of certain chlorinated aliphatic hydrocarbons by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to, and including, five, with varying amounts and positions of chlorine substitution. (This listing does not include wastewaters, wastewater treatment sludges, spent catalysts, and waste listed in Sections 261.31 or 261.32).
F025	Condensed light ends, spent filters and filter aids, and spent desiccant wastes from the production of certain chlorinated aliphatic hydrocarbons, by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to, and including, five, with varying amounts and positions of chlorine substitution.
F026	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta- or hexachlorobenzene under alkaline conditions.
F027	Discarded unused formulations containing tri-, tetra-, or pentachlorophenol or discarded unused formulations containing compounds derived from these chlorophenols. (This listing does not include formulations containing hexachlorophene synthesized from pre-purified 2,4,5-trichlorophenol as the sole component.)
F028	Residues resulting from the incinerations or thermal treatment of soil contaminated with U.S. EPA hazardous waste nos. F020, F021, F022, F023, F026, and F027.
F032	Wastewaters, process residuals, preservative drippage, and spent formulations from wood preserving processes generated at plants that currently use, or have previously used, chlorophenolic formulations, except potentially cross-contaminated wastes that have had the F032 waste code deleted in accordance with Section 261.35 (i.e., the newly promulgated equipment cleaning or replacement standards), and where the generator does not resume or initiate use of chlorophenolic formulations. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol.
F034	Wastewaters. process residuals. preservative drippage. and spent

Code	Description
	formulations from wood preserving processes generated at plants that use creosote formulations. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol.
F035	Wastewaters, process residuals, preservative drippage, and spent formulations from wood preserving processes generated at plants that use inorganic preservatives containing arsenic or chromium. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol.
F037	Petroleum refinery primary oil/water/solids separation sludge—any sludge generated from the gravitational separation of oil/water/solids during the storage or treatment of process wastewaters and oily cooling wastewaters from petroleum refineries. Such sludges include, but are not limited to, those generated in oil/water/solids separators; tanks and impoundments; ditches and other conveyances; sumps; and stormwater units receiving dry weather flow. Sludges generated in stormwater units that do not receive dry weather flow, sludges generated in aggressive biological treatment units as defined in Section 261.31(b)(2) (including sludges generated in one or more additional units after wastewaters have been treated in aggressive biological treatment units), and K051 wastes are exempted from this listing.
F038	Petroleum refinery secondary (emulsified) oil/water/solids separation sludge—any sludge and/or float generated from the physical and/or chemical separation of oil/water/solids in process wastewaters and oily cooling wastewaters from petroleum refineries. Such wastes include, but are not limited to, all sludges and floats generated in induced air flotation (IAF) units, tanks and impoundments, and all sludges generated in IAF units. Sludges generated in stormwater units that do not receive dry weather flow, sludges generated in aggressive biological treatment units as defined in Section 261.32(b)(2) (including sludges generated in one or more additional units after wastewaters have been treated in aggressive biological treatment units), and F037, K048, and K051 wastes are exempted from this listing.
F039	Leachate resulting from the treatment, storage, or disposal of wastes classified by more than one waste code under Subpart D, or from a mixture of wastes classified under Subparts C and D of this part. (Leachate resulting from the management of one or more of the following U.S. EPA Hazardous Wastes and no other hazardous wastes retains its hazardous waste code(s): F020, F021, F022, F023, F026, F027, and/or F028.)







Flammability	
4	Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.
3	Liquids and solids that can be ignited under almost all ambient conditions.
2	Must be moderately heated or exposed to relatively high temperature before ignition can occur.
1	Must be preheated before ignition can occur.
0	Materials that will not burn.



Reactivity	
4	Readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
3	Capable of detonation or explosive reaction, but requires a strong initiating source or must be heated under confinement before initiation, or reacts explosively with water.
2	Normally unstable and readily undergo violent decomposition but do not detonate. Also: may react violently with water or may form potentially explosive mixtures with water.
1	Normally stable, but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.
0	Normally stable, even under fire exposure conditions, and are not reactive with water.



Special Hazards	
<p>This section is used to denote special hazards. One of the most common is unusual reactivity with water. The letter W with a horizontal line through it (as shown above) indicates a potential hazard using water to fight a fire involving this material. Other symbols, abbreviations, or words may appear here to indicate unusual hazards. Some examples include the following (not all of which are necessarily part of the NFPA system):</p>	
OX	This denotes an oxidizer, a chemical that can greatly increase the rate of combustion/fire.
ACID	This indicates that the material is an acid, a corrosive material that has a pH lower than 7.0.
ALK	This denotes an alkaline material, also called a base. These caustic materials have a pH greater than 7.0.
COR	This denotes a material that is corrosive (it could be either an acid or a base).
	This is another symbol used for corrosive.
	The "skull and crossbones" is used to denote a poison or highly toxic material.
	The international symbol for radioactivity is used to denote radioactive hazards; radioactive materials are extremely hazardous when inhaled.
	Indicates an explosive material. This symbol is somewhat redundant because explosives are easily recognized by their reactivity rating.

GLOSSARY OF TERMS

In addition to the information below, Safety and Related Acronyms can be found at www.labsafety.org/acro.htm.

Absorption: The movement of a chemical-species through an interface. The taking up of one substance into the body of another (across a membrane) by molecular or chemical action (as a sponge takes up water).

Additives: Materials added to a mixture to achieve a particular protective outcome (for example, motor oil often contains detergents that cause the contaminating dirt and grime to remain suspended in the oil and not plate-out on motor parts).

Acutely Hazardous Waste (California uses the term “extremely hazardous”): A waste that can be considered to present a substantial hazard whether properly managed or not. Acutely hazardous wastes “pose an extreme hazard to the public health because of their carcinogenicity, high acute or chronic toxicity, bio-accumulative properties, or persistence in the environment.”

Air Emissions: Pollution discharged into the atmosphere from smokestacks, vents, and surface areas of commercial or industrial facilities. Air emissions are controlled by the requirements of the California Air Resources Board because they contribute to the generation of air toxics, loss of air quality, and the formation of photochemical smog.

ARI: Air-Conditioning and Refrigeration Institute. www.ari.org/.

Aromatic: A type of petroleum hydrocarbon based on benzene. Toluene, xylene, and other aromatics have a similar chemical structure and are known to be toxic.

ASTM: American Society for Testing and Materials. www.astm.org/.

BMP: Best management practices (BMP) are practices or structures designed to reduce the quantity of water pollutants, such as sediment, oils, heavy metals, etc. that are washed by rain and snowmelt from facility work-pads, parking lots, driveways, etc. into surface or groundwaters. BMPs include runoff control, spill prevention, and response procedures that will prevent or reduce the contamination of water supplies.

Boiling point: The temperature at which a liquid’s vapor pressure equals the imposed atmospheric pressure and internal vapor bubbles can form (boiling occurs). This value is sensitive to the applied atmospheric pressure (boiling point increases with increased pressure) and the concentration of contaminants in the otherwise pure liquid (boiling point increases with increased amounts of non-volatile material added to the liquid).

ARB: The California Air Resources Board is a part of the California Environmental Protection Agency, an organization that reports directly to the Governor's Office in the

Executive Branch of California State Government. The mission of the Air Resources Board is to promote and protect public health, welfare, and ecological resources through the effective and efficient reduction of air pollutants while recognizing and considering the effects on the economy of the state.

CCR: California Code of Regulations. Regulations adopted by California state agencies. www.calregs.com/.

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act.

CFC: Chlorofluorocarbons (CFC) are a family of inert, non-toxic, and easily liquefied chemicals used in automotive air conditioning, certain solvents, and aerosol propellants. Because CFCs can drift into the upper atmosphere (Stratosphere) where the chlorine is released, it can destroy the protective (UV radiation) ozone layer.

CFR: Code of Federal Regulations www.access.gpo.gov/nara/cfr/cfr-table-search.html.

Container: Any device in which hazardous waste can be stored, handled, treated, transported, recycled, or disposed of, and is designed to be portable when it is empty. Note: Oil filters are not considered containers (Title 22 CCR section 66261.7) and their required management is described in Title 22 section 66266.130.

Corrosivity: Used oil and other shop wastes are considered corrosive if they corrode (chemically etches through) steel at a rate of 0.25 inches per year or greater at a test temperature of 130°F and/or has a pH less than 2 or greater than 12.5 (Title 22 CCR section 66260.10).

“Cradle-to-Grave”: A “paper trail” procedure in which hazardous wastes are identified as they are produced, collected, stored, treated, transported, and disposed of by a series of permanent, linkable, documents. The Uniform Hazardous Waste Manifest is key to this accountability system.

SB 1082 in 1993 established the Certified Unified Program Agency (CUPA) program to reduce costs and improve the efficiency of environmental regulations in California.

The Unified Program will consolidate, coordinate, and make consistent the following six existing programs:

- ☐ Hazardous waste generators and hazardous waste on-site treatment.
- ☐ Aboveground storage tanks (SPCC plan only).
- ☐ Underground storage tanks (except for requirements of section 25297.1).
- ☐ Hazardous material release response plans and inventories.
- ☐ Acutely hazardous materials (Chapter 6.95, Article 2).
- ☐ Uniform Fire Code hazardous material management plans and inventories.

The CUPA program includes a single unified inspection and enforcement program. The following types of inspections must be conducted within the Unified Program:

- ☐ Hazardous waste generator inspections (H&SC Ch 6.5, Title 22 CCR).
- ☐ Inspection of on-site hazardous waste treatment activities under the conditionally exempt, conditionally authorized, and permit-by-rule tiers of Tiered Permitting (H&SC Ch 6.5, Title 22 CCR).
- ☐ Underground Storage Tank Program inspections (H&SC Ch 6.7, Title 23 CCR).
- ☐ Hazardous Materials Release Response Plans and Inventory inspections (H&SC Ch 6.95, Title 19 CCR).
- ☐ Risk Management and Prevention Program Inspections (H&SC Ch 6.95, Title 19 CCR).

CUPA: Certified Unified Program Agency.

Discharge: Usually refers to the release of a liquid waste into a body of water through an outlet such as a pipe, outfall, etc. but also refers to air emission from stacks, flues, vents, etc.

Disposal: The discharge, deposit, injection, spilling, leaking, or placing of any solid waste or hazardous waste into the environment (land, surface water, ground).

Distillation: A physical separation process based on the difference(s) in the boiling points of the components in a liquid mixture. A process of evaporation and re-condensation used to separate liquids into various fractions according to their boiling points.

DTSC: California Department of Toxic Substances Control.

Emergency Response: Means a response effort by employees from outside the immediate release area or by other designated responders to an occurrence, which results or is likely to result in an uncontrolled release of a hazardous substance (29 CFR 1910.120 (a)(3)).

U.S. EPA Identification Number: The 12-character number used by state and federal governments to track handlers of hazardous waste and used oil. The first two characters are the postal code for the state (in California, "CA"), the third character is either a letter or number, and the next 9 characters are numerals. A complete identification number looks similar to **CA0000123456**.

Extremely Hazardous Wastes: Defined by the Hazardous Waste Control Law (HWCL) as hazardous wastes which, if human exposure occurs, may likely result in death, disabling personal injury or serious illness. HWCL criteria judges a waste to be extremely hazardous if it is shown "to pose an extreme hazard to the public health because of its carcinogenicity, highly acute or chronic toxicity, bio-accumulative properties, or persistence in the environment"

Flash Point: The lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air.

Friable: A material that, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure.

Generator: Any person or site whose act or process produces hazardous wastes as identified or listed in 40 CFR 261.

Groundwater: Underground water supplied from an aquifer. The portion of subsurface water that is in the zone of saturation, where nearly all openings between soil particles are filled with water.

Halogenated Solvents: Hydrocarbon derivatives that contain one or more halogen atoms (bromine, chlorine, fluorine, etc.). The short chain-based solvents are an excellent dispersing medium for grease and oil and are used extensively as cleaning solvents and degreasers. Many of these substances are toxic, carcinogens, or harmful to the ozone layer.

Hazard: Refers to the presence of a chemical or piece of machinery that has inherent properties (for example, corrosivity, flammability, etc.) that could be harmful to a person who comes into contact with it. A hazard may be present but this does not necessarily mean that the situation is unsafe.

Hazard Communication Standard: Employers whose employees may have potential exposures to hazardous substances are required to develop a hazard communication program (OSHA 29 CFR section 1910.1200 and California Title 8 CCR).

The hazard communication standard is intended to ensure that employees are made aware of the dangers associated with the hazardous substances being used at their work site. The standard requires that the facility complete the following tasks:

- ☐ Develop a written hazard communication program.
- ☐ Provide training and safety information.
- ☐ Inventory (list) the hazardous materials present in the workplace.
- ☐ Obtain material safety data sheets (MSDS) for products listed in the inventory.
- ☐ Label containers with pertinent information.
- ☐ Develop methods to inform new hires, outside contractors, non-routine work assignments

Hazardous Material (chemical): Any substance, or mixture of substances, capable of producing adverse physical effects (fire, explosion, etc.) or adverse health effects (cancer, dermatitis, etc.) or damage to the environment. DOT, U.S. EPA and OSHA use differing criteria to define hazardous materials, substances, and wastes.

Hazardous Waste: "A solid waste or combination of solid wastes which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may:
(a) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; ... or

(b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.” (H&SC div. 20, section 6.5 25117)

Two types of RCRA wastes are listed wastes and characteristic wastes. Listed wastes are hazardous simply by virtue of the process that generates the waste, and characteristic wastes are hazardous only if they exhibit a hazardous characteristic.

Heavy Metals: High-density metallic elements (for example, mercury, chromium, cadmium, arsenic, and lead) which are generally toxic.

High Efficiency Particulate Air (HEPA) Filter: At least 99.97 percent efficient in the filtration of airborne particles 0.3 microns in diameter.

HSC also H&SC: Health and Safety Code.

HWCL: Hazardous Waste Control Law (California RCRA counterpart H&S Code section 25100 et seq)

Ignitability: Used oil, spent solvent wastes, shop rags, etc. can represent a fire hazard for the shop and the waste haulers who will be transporting the materials.

Liquid wastes are considered ignitable if they have a flash point of 140°F or less. Solid materials are considered ignitable if they can spontaneously catch fire at normal temperatures and pressures, or friction or the absorption of water causes them to catch fire (Title 22 CCR section 66261.21).

Inhalation Hazard: The breathing in of gases, vapors, fumes, etc., that can cause adverse health effects. An environmental condition that can cause harm to a worker through the breathing of toxic materials.

In-Process Recycling: Reusable by-products that are recovered and fed directly back into the process that created them are considered to be an example of source reduction (H&SC section 25244.14 (e)).

Incompatible Chemicals: Hazardous feedstocks or wastes that, if allowed to come in contact with each other, could violently interact producing heat, pressure, fire, explosion, toxic dusts, mists, fumes, or gases.

Joint and Several Liability: Responsibility together and individually. The person who has been harmed can sue and recover from all wrongdoers or from any one of the wrongdoers.

Land Disposal Restrictions (LDR): The Hazardous and Solid Wastes Amendment (HSWA) is referred to as the “land ban” regulation, because section 304 prohibited the land disposal/burial of certain hazardous wastes.

HSWA prohibits the disposal of non-containerized liquid hazardous wastes, certain absorbed liquid hazardous wastes and certain containerized hazardous wastes containing free liquids in landfills.

The LDR rules prohibit the land disposal of solvent wastes F001, F002, F003, F004, and F005, unless certain standards are met. Listed wastewater maximum concentrations for heavy metals, chlorinated solvents, petroleum (aromatic)-based solvents and derived organic solvents (acetone, MEK, creosols, etc.) will trigger the requirement for wastewater treatment or prohibition on land disposal.

Milk-Run: A group of automotive shops can arrange with a hazardous waste hauler for a shared "milk-run" pickup of used automotive liquids, especially if they are destined for recycling.

The consolidation of wastes into a single load does not relieve the individual generators of any significant hazardous waste management requirements, but it is economical because the hauler can optimize manpower and transportation costs (Title 22 CCR section 66263.42–66263.46).

Milk-run pickup is regulated under consolidated manifesting regulations. It allows certain registered hazardous waste transporters to combine specified wastes from multiple eligible generators on a single manifest, rather than using a separate manifest from each generator. The generators using the consolidated manifesting procedure are exempt from filling out a hazardous waste manifest. However, generators participating in this procedure must obtain identification numbers regardless of their size, except for generators of less than 100 kg. per month of "silver-only" hazardous wastes.

When automotive fluid wastes are collected in this manner, the hauler becomes the generator of the used wastes. The hauler fills out both the generator and the transporter portions of the Uniform Hazardous Waste Manifest with the necessary information and attaches a copy of the receipts given to the individual shops.

A hauler can call on a number of small shops, consolidate their used oil, spent solvents, brake fluid, antifreeze, etc., and produce a single manifested shipment.

MSDS: Material safety data sheet. A component of an OSHA-required digest that gives descriptive data concerning the hazards associated with a given chemical-based product. The MSDS is the basic vehicle for distributing information relating to hazardous materials used in the workplace as required by 29 CFR section 1910.1200 ("Worker's Right to Know").

Nonpoint Source Pollution: A source of pollution not associated with a distinct discharge point. Nonpoint sources include rainwater and snowmelt, runoff from industrial sites, parking lots, and construction operations. Stormwater control requirements apply to automotive shops.

Octane Rating: An arbitrary scale where n-heptane is assigned a value of zero (0) and iso-octane a value of 100. A gasoline sample is assigned a value based on the percentage of iso-octane that must be used with n-heptane to give the same knocking (pinging) characteristics as the gasoline being tested.

OWS: Oil/water separators.

Ozone Depletion: Destruction of the earth's stratospheric ozone layer. Chlorinated compounds drift upward into the stratosphere where they break down to form free chlorine that can destroy ozone molecules. The loss of stratospheric ozone molecules reduces the earth's shielding from ultraviolet radiation.

Permissible Exposure Limits (PEL): Limits for the amounts of certain chemicals that are in workplace air. The PELs are intended to protect the health of most people who are exposed every day over a working lifetime.

Permit: A document or requirement issued to authorize and/or regulate an activity that adds or may add pollutants to the environment.

Petroleum: Oil. A hydrocarbon mixture obtained from the earth through oil wells. In the past called "rock oil" to differentiate geologically extracted crude oil from oils derived from plants and animal sources.

Pollution: Degradation (impairment) of environmental quality by the release of substances that cause a health hazard or contaminate soil, water, or air. A chemical, biological or physical deviation from the natural condition (or established regulatory parameters) of a resource.

Pollution Prevention: Essentially source reduction. Pollution prevention emphasizes reduction of all wastes and emissions and discharges to air and water.

Publicly Owned Treatment Works (POTW): A sewage treatment system owned by a state, municipality, city, special sewer district, or other publicly owned political unit that is used to store and treat municipal sewage or industrial wastes.

Purification: Remove impurities to separate undesirable (unusable) components from a mixture and create a homogeneous product. For example, various hydrocarbon fractions must be separated out of crude oil. Contaminating metals, mineral salts, sediment, and water must be removed to insure product quality.

Resource Conservation and Recovery Act (RCRA): Enacted in 1976, this act requires a regulatory system to monitor and license the generation, treatment, storage, transport and disposal of hazardous wastes. It was amended in 1978, 1980, and again in 1984. The 1984 amendment was called the Hazards and Solid Waste Amendments Act. RCRA is a broad-reaching system with severe penalties to ensure compliance with its provisions.

Reactivity: Shop wastes (liquids and solid materials) are considered reactive if they are unstable, react violently, are capable of exploding or emit toxic gases when mixed with water, or are explosive (Title 22 CCR section 66260.10).

Rebuttable Presumption: This is an example of a “rebuttable presumption.” A used oil shipment contains more than 1,000 parts per million total halogens. It is *presumed* to have been mixed with halogenated hazardous waste and must be managed as a RCRA hazardous waste. By demonstrating the used oil had not been mixed with halogenated hazardous waste, the presumption is *rebutted*.

Recycling: The reuse or reclamation of waste after it has been generated, which can take the form of the following:

- ☐ Direct reuse as a raw material.
- ☐ Processing to remove impurities or regenerate for reuse.
- ☐ Recovery of useful components.

Regulations: Rules, orders, criteria, or performance standards, etc., adopted by a state agency to implement, interpret, or make specific the law enforced or administered by it.

Respirator: A device which “captures and removes” potentially harmful particulates and/or vapors (gases) from air drawn through it. These devices range from throwaway dust masks to cartridge respirators to self-contained breathing apparatuses, and they must be carefully chosen to provide protection of the wearer’s respiratory system from exposure to airborne contaminants.

Responsible Party: The original hazardous waste generator, the transporter, the site or facility operator, and the landowner all remain potentially liable for the ultimate cleanup costs, even if all procedures followed at the time of disposal met reasonable standards or even then-current regulatory requirements.

Risk: Relates to the probability that an adverse consequence will occur due to the presence of a hazard.

Sanitary Sewer: The sewer system used to carry wastewater or waterborne wastes from homes, businesses, and industries to the POTW. Storm water runoff is collected and conveyed in a separate system (the storm sewers) to natural waterways.

Secondary Containment: Systems designed to limit the movement of releases of hazardous liquids into the area surrounding their storage. These barriers take the form of liners, vaults, double-walled tanks, berms, etc. Secondary containment must be capable of collecting a potential release and of protecting groundwater or surface water supplies.

Standard Industrial Classification (SIC): The federal numeric code assigned to a given sector of U.S. business and industry. The SIC is used to promote comparability in economic data gathering that is used to describe various facets of the U.S. economy.

Each economic unit (business) is assigned an industry code on the basis of its primary activity, which is determined by its principal product or group of products produced or distributed, or services rendered. The following codes apply to automotive shops:

7538: General automotive repair shops.

7539: Automotive repair shops.

7549: Automotive services, except repair and car washes.

Source Reduction: An “up-front” effort to reduce the amount of waste initially generated, or to reduce the hazardous properties of wastes prior to their generation.

California’s SB 14 (Roberti, Chapter 1218, Statutes of 1989)

www.dtsc.ca.gov/PollutionPrevention/ states that source reduction is **NOT**:

- ☐ Actions that are taken after hazardous waste is generated, such as recycling, treatment, or incineration.
- ☐ Actions that merely concentrate the constituents of hazardous waste to reduce volume, or, conversely, dilute the waste to reduce its hazardous characteristics.
- ☐ Actions that merely transfer a pollutant from one environmental medium to another.

The Federal Pollution Prevention Act, 42 U.S.C. Section 13102 (5)(a) defines source reduction as any practice that reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment prior to recycling, treatment, or disposal.

Spill Prevention Control and Countermeasure (SPCC): Owners/operators of facilities that could reasonably be expected to discharge oil in harmful quantities into navigable waters are required by the CWA to prepare spill prevention control and countermeasure plans. These plans are designed to prevent oil spills and describe the response procedures to follow if a spill were to occur.

Storm Sewer: A separate system of conveyance that carries runoff from storms, surface drainage, and street wash, but does not include domestic and industrial wastes. Storm sewers are often the recipients of hazardous or toxic substances due to the illegal dumping of hazardous wastes or spills of water contaminants.

Strict Liability: Some statutes have no intent (criminal negligence) requirement. What must be proven is that the potentially responsible party's actions caused harm (damages). Even if compliant with all applicable laws and requirements at the time of producing, processing, and disposing of a hazardous waste, the commission of a proscribed act can make the generator liable.

Toxicity Characteristic Leaching Procedure (TCLP): An extraction test used to determine whether a waste is hazardous and/or requires treatment before it can be buried in a landfill.

Temperature Scale(s): Temperature is a representation of the “hotness or coldness” of a material sample. Values assigned as Fahrenheit, Celsius, or Kelvin readings represent the flow (movement) of heat energy (always higher temperature to lower temperature).

Toxicity: A waste is deemed toxic if it is shown "to pose a hazard to human health or the environment because of carcinogenicity, acute toxicity, chronic toxicity, bio-accumulative properties or persistence in the environment."

Toxicity is determined by specific tests for acute or chronic or bio-accumulative properties, including U.S. and California toxicity extraction procedures, "fish-kill" testing, etc. A waste is deemed toxic if an extract from a representative sample of the waste contains any of the listed toxic chemicals, at a concentration equal to or greater than the value applied to the substance by the regulations.

Treatment: Not considered a part of waste minimization. Includes actions that reduce the volume and/or hazardous properties of waste after its generation and prior to disposal or discharge ("capture and remove actions").

Toxic Substances Control Act (TSCA): A federal statute enacted in 1976 to regulate toxic substances not covered under other laws. The basic goals are to require industry to produce data on environmental effects of chemicals and to prevent harm to humans and the environment, while not creating unnecessary barriers to technology.

Treatment Storage Disposal Facility (TSDF): A landfill, incinerator, or other facility that receives hazardous waste for treatment, storage, or disposal. The Resource Conservation and Recovery Act (RCRA) includes general and specific requirements for treatment, storage, and disposal facilities. General requirements apply to all TSDFs, while the specific requirements apply to particular facility types. All TSDFs must have a permit.

Underground Storage Tank (UST): A tank and any underground piping connected to a tank that has 10 percent or more of its volume (including pipe volume) beneath the surface of the ground. USTs are designed to hold gasoline, other petroleum products, and hazardous materials.

Vapor: The gaseous form of substances that are normally liquids at room temperature, that is, water vapor = humidity.

Vapor Capture System: Any combination of hoods and ventilation systems that captures or contains organic vapors in order that they may be directed to an abatement or recovery device.

Viscosity: A liquid's resistance to internal flow due to intermolecular forces. The degree to which or the ease with which a liquid flows.

Volatile Organic Compound (VOC): Organic compounds that have a high evaporation rate and are precursors to photochemical smog.

Volatility: The tendency of a liquid to evaporate...produce vapors at ambient conditions.

Water Pollution: The impairment of water quality by agricultural, domestic, or industrial wastes to a degree that the natural water quality is changed to hinder any beneficial use of the water or render it offensive to the senses of sight, taste, or smell or when sufficient amounts of wastes create or pose a potential threat to human health or the environment.

LINKS

<http://es.epa.gov/oeca/metd/fft1.html>
<http://es.epa.gov/techinfo/facts/lamps-fs.html>
<http://home.earthlink.net/~irta/rprt0005.html>
<http://www.state.ia.us/dnr/organiza/wmad/wmabureau/Tires/TireFactSheet.pdf>
<http://wrrc.p2pays.org/indsectinfo.asp?INDSECT=5>
<http://www.asbestos-institute.ca/index.html>
<http://www.ccar-greenlink.org/vshops/checklist.html>
<http://www.ccp.com/~regiond/tires.html>
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<http://www.nfpa.org/Codes/interpretations/faq704/faq704.asp>

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- ❑ Automotive Fluids Management and Recycling Project, California Integrated Waste Management Board, Cosumnes River College, El Camino College, Western Partnership Environmental Technology Education.
- ❑ Santa Clara County, Nonpoint Source Pollution Control Program www.sccgov.org, click on: Doing Business/Business Laws and Regulations/Nonpoint Source Pollution/Common Pollutants.
- ❑ City of Los Angeles Department of Public Works.
- ❑ *Earth Resources—A Case Study: Oil*, California Integrated Waste Management Board.
- ❑ Georgia Tech Research Institute Environmental Management Branch, Georgia Institute of Technology, Atlanta, Georgia.
- ❑ Michigan Department of State Bureau of Automotive Regulation, P.O. Box 30046, Lansing, MI 48909-7546.
- ❑ Minnesota Pollution Control Agency, 520 Lafayette Road North, St. Paul, MN 55155-4194.